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IMPLEMENTATION GUIDE FOR USE IN DEVELOPING TECHNICAL SAFETY REQUIREMENTS

[This Guide describes acceptable, non-mandatory means for meeting requirements. Guides are not requirements documents and are not to be construed as requirements in any audit or appraisal for compliance with associated rules or directives.]



U.S. DEPARTMENT OF ENERGY
Office of Environment, Health, Safety and Security

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FOREWORD

This Department of Energy (DOE) Implementation Guide is available for use by all DOE components and contractors. Beneficial comments (recommendations, additions, deletions, and any pertinent data) that may improve this document should be sent to—

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DOE Guides are part of the DOE Directives System and are issued to provide supplemental information regarding the Department's requirements as contained in rules, Orders, Notices, and regulatory standards. Guides also provide acceptable methods for implementing these requirements.

This Guide may be used by all contractors for DOE Hazard Category 1, 2, or 3 nuclear facilities, including contractors for the National Nuclear Security Administration (NNSA). Throughout this document, references to a "contractor" or a "DOE contractor" apply to a contractor for NNSA as well.

This Guide was developed in support of Title 10 Code of Federal Regulations (CFR) Part 830, *Nuclear Safety Management*. It provides guidance for the requirements defined in 10 CFR §830.205, *Technical Safety Requirements*.

This Guide imposes no requirements.

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1 INTRODUCTION

1.1 Purpose

This guide provides information to assist in the implementation of 10 Code of Federal Regulations (CFR) §830.205, *Technical Safety Requirements*. More specifically, the guide provides methods acceptable to DOE for contractors to develop Technical Safety Requirements (TSRs) for Hazard Category 1, 2, and 3 nuclear facilities. The guide imposes no requirements, however, a contractor conscientiously following the analytical and drafting methods suggested below has assurance that compliance with 10 CFR §830.205 is being achieved. The rule specifies in subpart B, App A, G.4, “DOE Guide 423.X, *Implementation Guide for Use in Developing Technical Safety Requirements (TSRs)*, provides a complete description of what technical safety should contain and how they should be developed and maintained.” Other methods may be used, provided the resulting TSRs perform their intended purpose to ensure availability and operability of safety structures, systems and components (SSCs).

1.2 Terminology

Nearly all of the special terms used in this guide are defined in 10 CFR Part 830 Nuclear Safety Management, Department of Energy (DOE)-Standard (STD)-3009-2014 *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*, and DOE-STD-1189-2008 *Integration of Safety into the Design Process*. Terms not defined in these documents will be defined in the text.

1.3 Overview

DOE’s approach to ensuring the health and safety of the public with respect to nuclear safety is found in the provisions and appendices of 10 CFR Part 830. Many of the concepts found in this rule are based on regulatory approaches developed by the Atomic Energy Commission and later by the Nuclear Regulatory Commission (NRC). Those familiar with NRC’s safety regulations will note that DOE’s documented safety analysis (DSA) parallels NRC’s safety analysis report (SAR). In like manner, DOE’s Technical Safety Requirements (TSRs) parallel NRC’s technical specifications, or tech specs.

Analyzing the safety features of an existing nuclear facility or a design for a new nuclear facility begins with development of the DSA. This process is guided, in the main, by DOE-STD-3009. The accident analysis guided by this standard relies upon well-founded assumptions that are protected at a level commensurate with their importance. The purpose of TSRs is to ensure that safety class and safety significant SSCs are subject to controls ensuring availability and operability to the degree relied on in the DSA. Section 4 of this guide suggests acceptable methods for extracting TSRs from the DSA. Section 5 offers an acceptable approach to the structure and format of TSRs.

The four appendices cover special topics. Appendix A provides guidance on the structure and format of TSRs. Appendix B provides examples of acceptable TSRs. Appendix C addresses the performance of Independent Implementation of Verification reviews (IVRs) of safety basis

controls, while Appendix D offers methods for converting older safety controls such as tech specs and operational safety requirements to TSRs.

2 APPLICATION

The information contained in this guide is intended for use by all Department elements, including the National Nuclear Security Agency (NNSA), and all contractors for DOE-owned or DOE-leased Hazard Category 1, 2, or 3 nuclear facilities or nuclear operations. This Guide provides a format that is effective in highlighting the important features of TSRs. An older format was described in the attachment to DOE 5480.22, *Technical Safety Requirements*, dated 2-25-92, which was superseded by 10 CFR Part 830. If in place, the older format may be retained, but when the TSRs are significantly modified, the format in this guide should be considered. This format is based on the NRC Tech Spec Improvement Program (TSIP), and is designed to aid the use of operations information by the operators. However, neither the older format nor the new TSIP format is required. Other formats may be used as long as they meet the content expectations of Appendix A to Subpart B of the Nuclear Safety Management Rule.

This Guide does not apply to:

- activities regulated under a license issued by the NRC,
- activities regulated by a State under an agreement with the NRC (including activities certified by the NRC under §1701 of the Atomic Energy Act of 1954, 42 USC §2297f,
- activities conducted under the authority of the Director, Naval Nuclear Propulsion, pursuant to Executive Order 12344, codified at 50 U.S.C. §§2406, 2511,
- transportation activities regulated by the Department of Transportation,
- activities conducted under the Nuclear Waste Policy Act of 1982,
- any facility identified in §202(5) of the Energy Reorganization Act of 1974 (42 USC §5842), and
- activities related to the launch approval and actual launch of nuclear energy systems into space.

A contractor for an environmental restoration activity may follow the provisions of 29 CFR §1910.120 or §1926.65 for construction activities (see 10 CFR Part 830, Subpart B, Appendix A, Table 2) to develop hazard controls rather than TSRs. This option is available when the activity involves either (1) work not done within a permanent structure or (2) decommissioning of a facility with only low-level residual fixed radioactivity. DOE-STD-1120-2005, *Integration of Environment, Safety, and Health Into Facility Disposition Activities*, also provides guidance that should be considered in the development of TSRs for this type of facility.

Packaging and transportation of hazardous materials are governed by hazard controls but not TSRs discussed in this guide. Requirements and guidance for such hazard controls are found in the following documents:

- DOE Order 460.1C, *Packaging and Transportation Safety* (2010),
- DOE Guide 460.1-1, *Implementation Guide for Use with DOE O 460.1A, Packaging and Transportation Safety* (1997),

- DOE Order 460.2, *Packaging and Transfer or Transportation of Materials of National Security Interest* (2010), and
- DOE Manual 461.1-1, Admin Chg 1, *Packaging and Transfer of Materials of National Security Interest Manual* (2000).

3 BACKGROUND

DOE's nuclear safety requirements in 10 CFR Part 830 seek to accomplish four principal objectives: (1) Prevent the uncontrolled release of radioactivity to the environment; (2) prevent inadvertent criticality; (3) limit and monitor facility staff exposure to radiation and radioactivity; and, (4) protect the public from exposure to radiation and radioactive contamination. The first step in meeting these objectives is the drafting of a DSA. This document gathers together the information and analyses to be relied upon by DOE in authorizing the operation of any nuclear facility within the scope of the rule. DSAs define the performance capabilities of SSCs, and personnel, and are aimed at confirming the ability of the SSCs, and personnel to perform their intended safety function under normal, abnormal, accident, and specified failure conditions. The approved DSA defines the bounds for determining the existence of an "unreviewed safety question" and provides the analytical basis for developing and selecting safety limits to be set forth in Technical Safety Requirements, or TSRs, the subject of this guide.

TSRs can be viewed as a distillation of the DSA's analytical results for the required performance of safety SSCs. TSRs set forth the minimum acceptable limits for operations under normal and specified failure conditions and establish maintenance and surveillance requirements. In accordance with 10 CFR 830, all TSRs written by operating contractors, and proposed changes thereto, must be reviewed and approved by DOE before nuclear operations can commence.

Section 5 of a facility's DSA identifies needed TSRs and their technical basis. Subsection 5.5, "TSR Derivation," is intended to provide a link between the safety analysis and the list of variables, SSCs, and administrative procedures that are controlled to ensure safety.

In some cases, the DSA may not supply all of the input necessary for the development of a TSR. This situation may obtain in areas such as maintenance and surveillance frequencies and compensatory measures for systems out of service. In such cases, national and international codes, standards, and guides should be used if available. Where no code, standard, or guide is applicable, other documents such as reliability analyses, failure modes and effects analyses, manufacturer documentation, and data based on operating history may be used, along with engineering judgment.

The DSA and TSRs and facility-specific commitments when approved by DOE in a safety evaluation report (SER) constitute the nuclear safety basis and facility authorization from DOE for the contractor to operate Hazard Category 1, 2, and 3 nuclear facilities. Following approval of the DSA and TSR and issuance of the SER, the nuclear safety basis must be fully and effectively implemented prior to the start of nuclear operations in accordance with 10 CFR 830.

An IVR should be conducted to assure the full and effective implementation. Appendix C is a recommended procedure for the conduct of the IVR.

4 DEVELOPMENT AND CONTENT OF TECHNICAL SAFETY REQUIREMENTS

TSR development begins with completion of the DSA, which identifies those parameters that are to be controlled to ensure the safety requirements for the facility are met. A individual control may be governed by several different types of TSR, depending on the consequences associated with loss of control of that parameter. Low consequences may be dealt with by an administrative control, while high consequences may demand the use of a safety limit. The selection principles to be used are stated in Table 4 of Appendix B to 10 CFR Part 830.

The output of the TSR development process is a set of TSRs that controls all of the safety parameters relied upon in the DSA. As required by 10 CFR §205(a)(2), this set of TSRs must be submitted by the contractor to DOE for review and approval. During operations, any violation of a TSR must be reported to DOE [10 CFR §205(a)(3)].

4.1 TSR Development - Inputs from the DSA

TSR development begins with compiling a list of controls identified in a given DSA that require TSR coverage. For DSAs prepared in accordance with 10 CFR §830.204 using an acceptable methodology such as DOE-STD-3009, the list of controls should include all DSA commitments to provide TSRs for safety-class and safety-significant SSCs and SACs.

The following information from the DSA should be used to begin constructing TSRs:

- Specific safety functions called out,
- Implicit analytical assumptions,
- SSC interfaces and conditions that define operability,
- Key physical parameters (e.g., temperature, pressure, or distance),
- Assumptions or parameters that define inspection requirements,
- Facility description, including process and activity descriptions (DSA Chapter 2),
- Hazard analysis tables (DSA Chapter 3),
- Hazard analysis discussion of events with significant potential for uncontrolled release of radioactive or other hazardous material or energy, and the controls available to prevent or mitigate such events (DSA Chapter 3),
- Hazard analysis discussion of the events identified as presenting a significant hazard to workers and the controls available to prevent or mitigate such events (DSA Chapter 3),
- Accident analysis of the events that challenge offsite evaluation guidelines, and the controls available to prevent or mitigate such events (DSA Chapter 3),
- Safety structure, system, and component descriptions (DSA Chapter 4), and
- TSR derivation description (DSA Chapter 5).

4.2 Determining the Type of TSR Control

Once the items to be included in the TSRs are specified, it is necessary to determine the TSR control type appropriate for each item.

The specified types of TSRs are:

- Safety Limits
- Operating limits, subdivided into
 - Limiting Control Settings
 - Limiting Conditions for Operation
- Administrative Controls (including Programmatic and Specific Administrative Controls)
- Design Features

TSR preparers should select the TSR control type most appropriate for the item under consideration using the subsequent guidance. Once the TSR type for each relevant control is selected, TSRs should be written following the format offered in Appendix A of this Guide.

4.2.1 Safety Limits

Safety limits are defined as follows in 10 CFR §830.3:

Safety limits means the limits on process variables associated with those safety class physical barriers, generally passive, that are necessary for the intended facility function and that are required to guard against the uncontrolled release of radioactive materials.

4.2.2 Limiting Control Settings

Limiting control settings (LCSs) are the “settings on safety systems that control process variables to prevent exceeding a safety limit” (10 CFR §830.3). LCSs of instruments that monitor process variables are the settings at which protective devices actuate or alarms sound to alert facility personnel. An LCS includes specification of actions required when the limiting setting is exceeded. Assignment of an LCS also requires defining associated surveillance requirements that ensure continuous functioning of SSCs measuring the limiting setting or carrying out associated actions.

4.2.3 Limiting Conditions for Operation

Limiting Conditions for Operation (LCOs) are the limits “that represent the lowest functional capability or performance level of safety structures, systems, and components required for safe operations.” (10 CFR §830.3). They delineate the minimum conditions necessary to:

- (1) ensure that the initial conditions assumed in the analysis remain intact;
- (2) verify operability of an SSC; and
- (3) define actions to be completed.

LCOs include specific actions to be taken if minimum conditions are not met and define associated maintenance and surveillance requirements.

LCOs are specifically intended to cover active safety class and safety significant SSCs identified in the DSA. Such SSCs might include, for example, a ventilation system providing negative pressure, fire detection and suppression systems, and criticality alarm systems. Such systems prevent or mitigate hazards to the worker, the public and the environment. The LCO defines an active safety function of the SSC or SAC and how it is maintained. Vital passive SSCs, such as a rated, sealed fire wall, may be covered by LCOs if they are explicitly relied upon in the DSA to mitigate a design basis event. In other cases, passive SSCs may be controlled as TSR Design Features.

4.2.4 Administrative Controls

Administrative controls (AC) are “provisions relating to organization and management, procedures, recordkeeping, assessment, and reporting necessary to ensure safe operation of a facility.” (10 CFR §830.3)

Two types of administrative controls are used in nuclear facilities. The first type, termed a *specific administrative control*, or SAC, covers a single item of sufficient importance to be called out individually. When the DSA states that a SAC is relied on for safety, it should be the subject of a TSR. Guidance on the development and use of SACs is provided in DOE-STD-1186-2004, *Specific Administrative Controls*.

The second type of control, termed a *programmatic administrative control*, or AC, commits the facility operator to establish, maintain, and implement an element of a safety management program (SMP). Programmatic ACs frequently apply to safety programs such as radiation protection, criticality safety, fire protection, emergency preparedness, hazardous material safety, quality assurance, maintenance, and inventory control. ACs supporting effective safety administration covers generic topics such as facility procedures, contractor organization and management, safety reviews and audits, record keeping, operating support, minimum staffing, facility staff qualification and training, and TSR deviations.

An active SSC may sometimes be covered by a SAC. This approach can be taken when flexibility in implementation is desired or when the SSC naturally falls under an area of routine programmatic supervision. Using a SAC as an expedient alternative to an engineered control should, however, be avoided. SACs may be acceptable for ensuring safe operation in some cases, but they generally do not connote the same level of reliability associated with an LCO.

4.2.5 Design Features

Design features (DF) are those passive controls that, if altered or modified, could have a significant effect on safe operation. DFs are normally passive characteristics of the facility, not subject to significant alteration by operations personnel, which accomplish their function without a change of state. Examples include shielding, structural walls, glove boxes, relative locations of major components, installed poisons, and special material.

4.3 TSR Document Organization

A TSR document should have the following major sections:

- Front Matter
- Use and Application (Section 1)
- Safety Limits (Section 2)
- Operating Limits and Surveillance Requirements (Sections 3/4)
- Administrative Controls (Section 5)
- Design Features (Section 6)
- Bases Appendix

Each of these major sections is discussed below. See Appendix A for structure and format details.

4.3.1 Front Matter

The front matter section of a facility TSR should consist of the following parts:

1. Title page (with appropriate document classification)
2. List of affected pages
3. Table of contents
4. List of tables and figures
5. List of acronyms, abbreviations, and symbols
6. Record of changes

The lists for tables, figures, and acronyms may not be required if none are contained in the body of the TSR document. The list of tables or figures is a simple three-column list with the first column being the unique figure or table number, the second column being the description or title, and the last column showing the page number where the item can be found.

Changes to the TSRs should be indicated by:

- a list of pages in effect with page number and date,
- a record of revision pages,
- sidebar changes in the TSR text, and
- page number, document number, and the revision number.

Appendix A of this guide provides a recommended format for each of the above subsections.

The acronym list should be as short as possible. An acronym should be used only where the term is repeated a number of times. Definitions of acronyms in the list should be verified to match the precise meaning of the terms as used in the TSR.

4.3.2 Use and Application

The Use and Application Section provides:

The basic instructions for applying the safety restrictions contained in a technical safety requirement. The use and application section includes definitions of terms, operating modes, logical connectors, completion times, and frequency notations. (Table 4, 10 CFR Part 830, Subpart B, Appendix A)

The Use and Application section is placed first to provide the ground rules for use of the TSR before presenting any requirements. This section will contain essential information for understanding the rest of the TSR. It should reference the DSA as necessary but should not be a tutorial on the entire facility.

This section of the TSR will be subdivided into subsections based on the complexity and nature of the TSR document itself. This section should include at a minimum the following subsections:

- Definitions of Terms
- Operating Modes
- Logical Connectors
- Completion Times
- Frequency Notations

Definition of Terms

The list of definitions should be alphabetically arranged in tabular form. When used in the TSR document, these terms should appear in all uppercase when the precise definition provided in the definition section is intended. The list of definitions should contain the more frequently encountered definitions found in TSRs. TSRs should be carefully reviewed to ensure that terms are used in a manner consistent with the definitions list. Terms used in the TSR that are in common parlance should not be listed.

Operating Modes

Operating Modes represent the facility SSC configurations that preserve safety in different phases, or modes, of facility operations. Mode distinctions are determined by differences in process parameters or needed safety controls and equipment for different operational states.

Examples of mode definitions are found in Appendix B. The example modes show the operational distinctions that can be made. In the “safest mode,” certain TSR requirements do not apply. For example, a TSR may apply only when specific operations are under way, and thus does not apply when these operations are shut down. However, for some nuclear facilities it may not be possible to define a mode where TSRs do not apply, as the hazard is always present. In that case, the safest mode is that which minimizes risk.

In general, requirements applicable in a given mode are required for all actions or conditions represented by this mode. The TSR writer should ensure that the mode requirements are in alignment with how the specific LCO control is credited in the DSA. For example, if a fire protection system is credited whenever material-at-risk (MAR) is within the nuclear facility, the LCO for the fire protection system should be applicable in all modes in which MAR is present.

Completion Times

Completion Time is the amount of time allowed for completing a required action. It might be, for example, the time interval allowed for carrying out compensatory measures or restoration activities when an Action Statement has been entered.

Frequency Notation

The “Specified Frequency” typically consists of (a) requirements of the frequency column of each surveillance requirement, and (b) any notes in the surveillance requirement column modifying performance requirements. Sometimes special situations dictate when the surveillance requirements are to be met, as when an event triggers the need for a surveillance action. These special situations should be stated in the TSR document. Examples of frequency notations are found in Appendix B.

4.3.3 Safety Limits

Appendix A to Subpart B of 10 CFR Part 830 defines safety limits as follows:

The limits on process variables associated with those safety class physical barriers, generally passive, that are necessary for the intended facility function and that are required to guard against the uncontrolled release of radioactive materials. The safety limit section describes, as precisely as possible, the parameters being limited, states the limit in measurable units (pressure, temperature, flow, etc.), and indicates the applicability of the limit. The safety limit section also describes the actions to be taken in the event that the safety limit is exceeded. These actions should first place the facility in the safe[st], [most] stable condition attainable, including total shutdown (except where such action might reduce the margin of safety) or should verify that the facility already is safe and stable and will remain so. The technical safety requirement should state that the contractor must obtain DOE authorization to restart the nuclear facility following a violation of a safety limit. The safety limit section also establishes the steps and time limits to correct the out-of-specification condition.

Safety Limits control important process variables to prevent the uncontrolled release of radioactive materials.

Reactor Facilities. Typical reactor limits of importance and possible candidates for SLs are those placed on primary coolant system pressure, primary coolant system temperature, and reactor power. For reactors without closed primary coolant systems (such as pool-type

reactors), or with primary coolant systems that operate at essentially atmospheric pressure, the main candidates for SLs would be maximum reactor power and water temperatures. Generally, containment or confinement systems should not be considered as barriers that require SLs because they are mitigative in nature. However, these systems should be considered in the development of LCOs because they typically provide important defense-in-depth or worker safety protective features. For reactors, typically these barriers are considered to be the fuel cladding and primary coolant system, including piping and pressure vessels. LCSs for reactors should include reactor trip system instrumentation set points. Reactor trip set-point limits should be selected to provide sufficient margin between the trip set point and the SL. This margin will ensure that the core and the reactor coolant system do not exceed SLs during normal operations and anticipated operational occurrences

Nonreactor Nuclear Facilities. Passive barriers preventing the uncontrolled release of radioactive and other hazardous materials are (a) the process material boundary (such as a shell casing, vessel, or tank) closest to the source, (b) a fully-enclosed room designed to withstand explosions, fires, and similar phenomena, and (c) the building itself. Limits of importance for non-reactor nuclear facilities tend to be facility-specific, though often may relate to physical variables such as pressure and temperature.

Limiting Control Settings (LCS) define the settings on safety systems that will ensure process variables remain within applicable SLs. For all facilities, LCSs should be chosen so that there is adequate time after exceeding a normal setting to correct the abnormal situation, automatically or manually, before an SL is exceeded.

When developing TSR limiting values or set points based on the DSA, the TSR developer should bear in mind that values in the DSA are generally the exact values at which something is assumed to happen. Because the values and set points in the TSR are measured and hence have some margin of error, TSA set points should be chosen on the conservative side of the DSA assumptions. The adjustments should account for calibration uncertainty, instrumentation uncertainty during operation and accident conditions, and instrument drift. The DSA and TSR developer, if not the same person, should work together to ensure that the DSA HA/AA is preserved through compliance with the TSR.

4.3.4 Operating Limits & Surveillance Requirements

4.3.4.1 Operating Limits

Appendix A to Subpart B of 10 CFR Part 830 defines operating limits as follows:

Those limits which are required to ensure the safe operation of a nuclear facility. The operating limits section may include subsections on limiting control settings and limiting conditions for operation.

DOE's TSRs generally do not contain a separate section titled "Operating Limits." TSRs are typically written in a format that combines Operating Limits as LCS/LCOs in Section 3 with Surveillance Requirements (SR) in Section 4 in the facility's TSR document followed by the

number and name associated with the group that yields LCS/SR and LCO/SR in Sections 3/4.x. LCS/LCOs define the limits that represent the lowest functional capability or performance level of safety SSCs or SAC required to perform an activity safely. SRs verify whether or not the minimum operability requirements of LCS/LCO-required safety equipment or parameters are satisfied.

4.3.4.2 Limiting Control Settings

Appendix A to Subpart B of 10 CFR Part 830 defines limiting control settings as follows:

The settings on safety systems that control process variables to prevent exceeding a safety limit. The limited control settings section normally contains the settings for automatic alarms and for the automatic or nonautomatic initiation of protective actions related to those variables associated with the function of safety class structures, systems, or components if the safety analysis shows that they are relied upon to mitigate or prevent an accident. The limited control settings section also identifies the protective actions to be taken at the specific settings chosen in order to correct a situation automatically or manually such that the related safety limit is not exceeded. Protective actions may include maintaining the variables within the requirements and repairing the automatic device promptly or shutting down the affected part of the process and, if required, the entire facility.

At a minimum, each individual LCS should contain a LCS statement, a mode applicability statement, action statements, and SRs.

LCSs should be based on, and specified in terms of, three rules:

Rule 1: Compliance with an LCS is required in the modes specified.

Rule 2: Upon discovery that the instrumentation or interlock set point is less conservative than the required LCSs, the associated action should require that it be reset. Other requirements such as allowable outage times should be specified.

Rule 3: If an automatic safety system is not operable as specified, the action statement should describe the appropriate action to restore the affected system to an operable condition. The LCS should specify the allowed out-of-service time permitted when testing, resetting, repairing, or maintaining trip devices and similarly the time permitted for associated equipment to be removed from service for these activities.

4.3.4.3 Limiting Conditions for Operation

Appendix A to Subpart B of 10 CFR Part 830 defines limiting conditions for operation as follows:

The limits that represent the lowest functional capability or performance level of safety structures, systems, and components required to perform an activity safely. The limiting

conditions for operation section describes, as precisely as possible, the lowest functional capability or performance level of equipment required for continued safe operation of the facility. The limiting conditions for operation section also states the action to be taken to address a condition not meeting the limiting conditions for operation section. Normally this simply provides for the adverse condition being corrected in a certain time frame and for further action if this is impossible.

Any SSC or SAC providing a credited safety function in the DSA for an assumed accident or transient sequence should be included in the LCOs. Each LCO should be established at a level that will ensure the process variable is not less conservative during actual operation than was assumed in the safety analyses. LCOs should also cover SSCs that either provide support for or actuate a system credited in the DSA. SSCs that support the safety function of another SSC may be covered by separate LCOs if that approach simplifies implementation. A common example of separate coverage is an emergency diesel generator providing backup electrical power to a ventilation system.

LCOs should be written in a user-friendly manner to assist an operator faced with adverse, stressful conditions. The LCO should communicate quickly and effectively the information needed by the operator to assess and properly respond to off-normal and accident conditions. The operator should be able to grasp quickly from looking at the LCO (a) what operating parameters/conditions represent the lowest functional capability or performance for a specified required Limiting Condition, (b) how to measure or determine whether that parameter condition is met, and (c) what to do if a Limiting Condition is not met.

The following are good practices in LCO development:

1. The TSR developer should consult with facility engineers in the development of an LCO to ensure ease of implementation.
2. Area applicability should be defined so that the LCO is only required for the facility areas for which it is credited. The TSR developer should consider whether subdivision of an area might ease implementation.
3. The LCO should only be specified for limited processes if the accidents for which the control is credited applies only to certain processes.
4. If the LCO is mode-specific, the conditions that must be maintained in those modes should be specified. For conditions that vary by mode, a separate LCO should be written for each mode. Placing the facility in a mode where the LCO is not applicable is always an option to consider. Once action is taken to enter a mode where the LCO is not required, the facility has exited the LCO.
5. Multiple parameters grouped under one SR should be avoided, as it may be unclear which action to enter if the SR is not met. Parameters specified to be met must be measurable or readily determinable. Actions should be specified that are reasonable to perform within the required time specified. The TSR developer should also consider the conditions under which surveillances or

actions need to be performed. Under normal conditions it might be reasonable to expect an operator to climb a ladder to shut a roof vent within 20 minutes. This action might be dangerous or impossible under actual fire conditions.

6. One aid to LCO usability is to minimize the number of different conditions of operability. TSR developers sometimes minimize the total number of LCOs at the expense of individual LCO simplicity. One to three conditions are usually considered ideal for the user. When the number of conditions approaches or exceeds about six, the operator has difficulty grasping the entire LCO and it begins to become unwieldy. When the LCO becomes this complex, splitting it into two or more LCOs should be considered. Conditions could be split among systems/subsystems, grouped by similar required actions or surveillances, or grouped by area. Conditions must always be grouped by mode such that all conditions apply to all modes specified in the applicability at all times. If there are different requirements for different modes a separate LCO should be specified for each mode.

7. Another way to simplify conditions is consolidation. This technique may be useful when all the conditions are the same except for one parameter such as MAR limits. In this case, a single condition can be specified with reference to a “look-up” table. This table should be placed directly below the condition or within the body of the TSR itself. Placing this table in the bases should be avoided and it should never reference an external document.

4.3.4.4 LCS/LCO Statement

LCS/LCO specification statements should be concise. The objective is to distill a clear, precise statement or specification of operability. Examples of such concise statements:

The criticality alarm system shall be OPERABLE with two detection channels and an alarm set point for each detector set at less than or equal to 100 mR/hr.

The exhaust ventilation system shall be OPERABLE with two exhaust fans maintaining flow greater than or equal to 2,500 cfm and two HEPA filter banks each with a removal efficiency greater than or equal to 99.9% for 0.3 micron particles or greater.

The LCS/LCO specification statement typically focuses on the most important SSCs and parameters and is not required to list all subcomponents. The complete list is provided in the SRs demonstrating compliance with the LCO statement, except where key support SSCs have been assigned their own individual LCO. In some cases, concise LCS/LCO specification statements may lead to multiple LCSs/LCOs for the same equipment and modes. This is an acceptable outcome.

4.3.4.5 Action Statements

Action statements should describe the actions to be taken in the event that an LCO is not met. An action statement should establish the steps and agreed upon time limits to correct the condition or conditions that are beyond the TSR’s limits.

Action statements generally fall into three categories:

- **Restorative:** The action statement might provide that a certain adverse condition must be corrected in a certain time frame and that further action must be taken if corrective action cannot be taken in a stated amount of time. For example, if an LCO requires two pumps to be operable at all times when in the “normal operations” mode, the action statement might require that if one pump is inoperable, it must be made operable in X hours or operations must cease within the following Y hours. If both pumps became inoperable, the action statement would likely require cessation of operations and restoration of at least one pump within Z hours and the second pump within W hours.
- **Eliminative:** This type of action places the facility in a mode or condition in which the DSA credited safety function is no longer required. If such a mode or condition is not practical, the facility or operation may be placed in a condition that reduces the probability of occurrence of the accident for which the safety function is credited in the DSA, for a limited period of time.
- **Compensatory:** This type of action replaces the lost safety function with another device or a manual action that substitutes for the unavailable safety function.

An action statement should provide a clear, logical method to reach a safe and stable state. However, in complex facilities care must be taken to ensure that an action statement does not inadvertently decrease safety. Occasionally, it may be necessary for an action statement to specify transition through an operating mode even though required safety equipment would be inoperable for the transitional state.

When an LCO is not met, action should be initiated within the completion time provided in the action statement to place the facility in a mode in which the requirement does not apply. Entry into a different mode should not be made unless all of the LCOs are met for that mode, except for the passage through a mode as required to comply with action statements.

4.3.4.6 Operability

Operability embodies the principle that an SSC can perform its credited safety function(s) as described in the DSA. This principle extends the requirements of an LCO for those SSCs that directly perform a specified safety function (supported systems) to those that perform a required support function (support systems). Operability applies only to SSCs.

An SSC can be degraded but still “operable” if it remains capable of performing its required safety function at the level assumed in the accident analysis. If SSCs are observed to be functioning but under stress (such as elevated temperature, vibration, or physical damage), then judgment supported by an engineering analysis should be used to decide whether operability is being maintained.

These general principles of operability should be followed in generating LCOs:

- An SSC is considered operable as long as there exists a sound technical basis for believing that it is capable of performing its specified safety function(s).
- An SSC can perform its specified safety function(s) only when all of its necessary support systems are capable of performing their related support functions.
- When all SSCs designed to perform a certain safety function are not capable of performing that safety function, a loss of function condition exists.
- When an SSC is determined to be incapable of performing its intended safety function(s), the declaration of inoperability should be immediate.

4.3.4.7 Allowable Outage Times

Allowable Outage Time (AOT) is the allowed time, specified in the TSR, that an SSC can be out of service without entering a required LCO action. The AOT concept applies only to taking an SSC out of service for planned maintenance or testing.

Generally, the AOT of a support system should be shorter than the minimum AOT of the system it is supporting. In actual practice, however, the reverse situation may arise. In such cases, the supported system's LCO action statements should require a mode change to one in which the operability of the supported system is not required. This would be set to occur before the expiration of the support system's AOT.

4.3.4.8 Surveillance Requirements

Appendix A to Subpart B of 10 CFR Part 830 defines surveillance requirements as follows:

Requirements relating to test, calibration, or inspection to assure that the necessary operability and quality of safety structures, systems, and components is maintained; that facility operation is within safety limits; and that limiting control settings and limiting conditions for operation are met. If a required surveillance is not successfully completed, the contractor is expected to assume the systems or components involved are inoperable and take the actions defined by the technical safety requirement until the systems or components can be shown to be operable. If, however, a required surveillance is not performed within its required frequency, the contractor is allowed to perform the surveillance within 24 hours or the original frequency, whichever is smaller, and confirm operability.

Surveillance Requirements (SRs) are used to ensure operability or availability of the safety SSCs and SACs identified in the OLs. SRs are most often used with LCS/LCOs to periodically validate the operability of SSCs that are subject to a limiting condition. The system is presumed to be operable if the surveillance requirements have been met. The system is presumed to be operable if its surveillance requirements have been met.

SRs consist of short descriptions of the type of surveillance required and the required frequency of performance. These statements should identify those requirements needed to ensure compliance with the related OLs. Failure to perform a surveillance within the required time interval, or failure of the SSC to meet acceptance criteria during surveillance tests, require that the SSC be declared inoperable.

The TSR writer should consider developing general SRs that corresponded to the general LCOs (see Appendix B, Figures 7a and 7b, for examples). Upon discovery of a missed surveillance test, a grace period such as 24 hours or the time limit of the specified surveillance frequency, whichever is less, may be allowed to complete the surveillance before taking the required action of the LCO. Such grace periods should be stated explicitly in an SR. There may be process systems for which it is not acceptable to apply the concept of a grace period because failing to perform the surveillance or maintenance places the system in a state requiring immediate corrective action.

4.3.4.9 Surveillance Requirement Statements

SR statements consist of definitions of the type of surveillance required to verify operability of SSCs. Examples:

Verify that the pressure in Room 27A is a minimum of 0.05 inch WG lower than the outside atmospheric pressure by checking the wall-mounted differential pressure gage.

Perform a channel functional test on each criticality alarm system detector using an external radiation source.

The total collection of SR statements associated with a given LCS/LCO should (a) confirm operability of required SSCs, and (b) maintain facility operations within LCS/ LCOs operating parameters.

4.3.4.10 Surveillance Requirement Frequencies

SR frequencies are direct statements of the time interval in which the surveillance must be performed. One-word statements such as weekly, monthly, quarterly, or annually are preferred. The interval can be based on specific DSA assumptions, national and international codes, standards, and guides, reliability analyses, failure modes and effects analyses, manufacturer documentation, information from operating history, or engineering judgment.

4.3.5 Administrative Controls

Appendix A to Subpart B of 10 CFR Part 830 defines administrative controls (ACs) as follows:

Organization and management, procedures, recordkeeping, assessment, and reporting necessary to ensure safe operation of a facility consistent with the technical safety requirement. In general, the administrative controls section addresses (1) the requirements associated with administrative controls, (including those for reporting violations of the technical safety requirement); (2) the staffing requirements for facility positions important to safe conduct of the facility; and (3) the commitments to the safety management programs identified in the documented safety analysis as necessary components of the safety basis for the facility.

Administrative Controls can be “programmatic” or “specific.” Programmatic controls describe safety management programs that are assumed in the DSA to be functional and properly maintained. Specific administrative controls, or SACs, identify requirements explicitly credited in safety analysis. In general, the ACs should document all those administrative functions that are required to meet facility safety criteria as identified in the DSA, including commitments to safety management programs. ACs may include reporting deviations from TSRs, staffing requirements for facility positions important to safe operation of the facility, and commitments to safety management programs important to worker safety.

Efforts should be made to use engineered SSCs whenever possible for controlling the likelihood and consequences of accidents. ACs should be considered as defense in depth measures rather than as primary or redundant controls. While ACs may be acceptable for ensuring some aspects of safe operation, their generally lower reliability, compared with engineered controls, should be weighed when choosing safety measures for long-term hazardous activities.

Human actions, taken either in response to an event or taken proactively to establish desired conditions, are subject to errors of omission or commission. Sets of ACs are prone to common cause failure. The following attributes can increase human reliability:

- use of reader/worker/checker systems;
- independent verification;
- positive feedback systems;
- human factor analysis;
- operator training and certification;
- continuing training and requalification;
- abnormal event response drills;
- ergonomic considerations in procedures; and
- conduct of operations.

When invoking ACs for control of accident scenarios, the preceding attributes, appropriate to the consequences of the accidents they are intended to prevent, should be considered.

4.3.5.1 Programmatic Administrative Controls

A programmatic AC represents commitments to establish, implement, and maintain a safety management program. Safety management programs that might be covered by an AC include quality assurance, procedures, maintenance, training, conduct of operations, emergency preparedness, fire protection, waste management, and radiological protection. ACs supporting effective safety administration cover generic topics such as facility procedures, contractor organization and management, safety reviews and audits, record keeping, operating support, minimum staffing, facility staff qualification and training, and TSR deviations. The cumulative effect of these safety management programs is recognized as being important to overall facility safety. A TSR violation may be declared when a safety management program fails to a degree that DSA assumptions are invalidated.

Programmatic ACs typically begin with the phrase, “A program shall be established, implemented, and maintained to ensure that . . .” For example:

A radiation protection program shall be established, implemented, and maintained to ensure that radiation exposure to employees, subcontractors, visitors, and members of the general public is controlled in accordance with requirements of 10 CFR Part 835.

Some programmatic ACs highlight major aspects of the program in bullet fashion. For example:

A fire protection program shall be established, implemented, and maintained to minimize the likelihood of fire in accordance with all contractor-applicable provisions of DOE Order 420.1C. Key elements of this program include:

- a safety significant fire suppression system;
- maximum room fuel loading of 10 kg/m² as verified by periodic inspections;
- allowance for only incidental quantities of flammable or combustible liquids in three appropriate storage cabinets; and
- use of non-combustible storage racks in glovebox processing lines 5, 8, and 12.

Specifying key elements does not automatically convert those elements to SACs. Note that active SSCs are sometimes assigned to ACs as well. This can be done for less critical SSCs when flexibility in implementation is desired or when the SSC naturally falls under an area of routine programmatic supervision.

4.3.5.2 Specific Administrative Controls

A Specific Administrative Control is identified in the DSA as an administrative control needed to prevent or mitigate an accident scenario. Factors utilized to designate an AC as a SAC include:

- The AC is the basis for validity of the hazard/accident analysis, as in the case of a MAR limit.
- The AC provides the main mechanism for hazard control.

SACs can be presented in the TSRs in either of two formats: *LCO/SR* or *Directive Action*. LCO/SR format should be used when SAC is well-defined, clear corrective actions available, and supporting conditions can be easily verified. Guidance for an SSC-related LCO/SR provided in Section 4.4 is applicable to an SAC written in LCO/SR format. LCO/SR format may be more appropriate and preferred for an active SSC if:

- A clear distinction between operable and inoperable is desired.
- Specific surveillances are required.
- The actions to respond to an inoperable condition must be clearly spelled out.
- What constitutes a TSR violation for an LCO is better defined than for an AC.

Directive Action SAC format is used when it is essential that SAC be performed when called upon every time and without delay. A violation of a Directive Action SAC is an immediate TSR violation. (See Section 2 of Appendix A for details.) DOE-STD-1186-2004 provides additional guidance and expectations for SACs.

Note: For Hazard Category 3 facilities, TSRs may consist solely of an inventory limit to maintain the Hazard Category 3 classification and other ACs that provide appropriate commitments to safety programs. This minimum expectation does not apply to all circumstances, but demonstrates that a more liberal use of ACs can be acceptable for Hazard Category 3 facilities.

An example SAC: “TRU waste containers shall not be stacked more than two levels high, and the bottom of the second level shall be stored no more than nominally 4 feet above ground.”

4.3.6 Design Features

Appendix A to Subpart B of 10 CFR Part 830 defines Design Features as follows:

Design features of the facility that, if altered or modified, would have a significant effect on safe operation.

Design Features (DFs) specify the inherent characteristics or qualities of an object or component required to protect the validity of the DSA accident analysis. DFs may be intrinsic characteristics—such as enrichment, neutron absorption, fire rating, and load capacity—or physical characteristics such as siting, berms, and fueling locations.

DFs are normally passive attributes of the facility not subject to significant alteration by operations personnel. Examples of passive attributes include shielding, structural walls, relative locations of major components, installed reactivity poisons, or special materials. The DF section captures those permanently built-in features critical to safety that do not require, or infrequently require, maintenance or surveillance. The attributes of the passive DFs that are important in the DSA should be described completely. Active safety features that are controlled by other types of TSRs should not be included in the DF section.

Surveillance requirements for DFs are typically located in programs such as configuration management or in-service inspections (ISIs). In some cases it may be appropriate to include or reference ISIs for design features in section 6 of the TSR.

4.3.7 Bases Appendix

Appendix A to Subpart B of 10 CFR Part 830 defines Bases Appendix as follows:

The reasons for the safety limits, operating limits, and associated surveillance requirements in the technical safety requirements. The statements for each limit or requirement shows how the numeric value, the condition, or the surveillance fulfills the purpose derived from the safety documentation. The primary purpose for describing the basis of each limit or

requirement is to ensure that any future changes to the limit or requirement is done with full knowledge of the original intent or purpose of the limit or requirement.

The bases appendix provides summary statements of the reasons for the selection of each specific SL, OL, and SR. The bases appendix should summarize and reference any more specific analyses related to the TSRs and their derivation. The bases should (a) describe the credited safety functions in the DSA that each safety system or SAC provides (b) identify what is included in each safety system or SAC, (c) identify all requirements relevant to the safety basis that has been selected, and (d) identify specific information from the DSA used in the derivation of individual TSRs. The level of detail in the descriptions should be sufficient for the operations staff to confirm that the system is operable or that a SAC is met. Although Part 830 requires that a basis be provided only for “safety limits, operating limits, and associated surveillance requirements,” it is a good practice to provide a technical basis for other aspects of TSRs, when practical.

The bases appendix is divided into seven areas: background, application to safety analysis, SLs and OLs, mode applicability, Action Statements, SRs, and references:

- **Background.** Discuss in a general way the function of each system, component or SAC. Include relevant major components and a schematic (if a system), operational aspects, unique features, and general design features. Limits protected by the requirement, and the consequences of exceeding the limits, should be discussed. This section should also cross-reference related or similar requirements.
- **Application to Safety Analysis.** Discuss the evaluations included in the safety analysis from which the requirement has been derived, including:
 - applicable accident or transient;
 - major input assumptions of the safety analysis;
 - relationship of this TSR to the accepted consequence of the analysis; and
 - basis of each SL or OL, including allowances.
- **SL or OL.** For SLs, identify in the DSA the specific barrier protected by the SL and the accident or accidents for which maintaining the integrity of the barrier is necessary to protect public health and safety. For LCSs or LCOs, explain why the requirement is suitable. Discuss how it was determined to be the minimum functional capability or performance level for that system or component to ensure safe operation of the facility. Discuss any other relevant facets of the LCS or LCO, such as conditions required, numbers of components required, parameter requirements, exceptions or notes, and implications of LCS or LCO violations.
- **Mode Applicability.** Present information on expected and distinguishable operational conditions suitable to be considered separate modes.
- **Action Statement.** For each action statement:

- Explain why the actions should be taken and why continued operation is acceptable if the LCO is not met;
 - Address the level of protection provided, the probability of an event occurring during the period covered, and how the required actions compensate for LCO deviations;
 - Explain the technical basis for completion times;
 - Describe why mode changes are required;
 - Discuss how all required actions for an LCO relate to each other;
 - Explain the source of all numerical values such as completion times, parameter values, and component requirements.
- **Surveillance Requirement.** For each SR:
 - Discuss how the surveillance demonstrates operability of the LCO requirements;
 - Discuss how the surveillance verifies the LCO requirements; this discussion should establish a one-to-one correspondence between each SR and LCO;
 - Explain why the SR is necessary at the frequency specified; and
 - Provide justification for surveillance test frequencies, using, engineering judgment or probabilistic risk assessment and parameter values.
- **References.** In all sections of the TSR, identify the applicable DSA section, applicable reports, and relevant codes and standards. It is good practice to provide a list of documents where more detailed information pertinent to the TSRs can be found. For any reference cites, provide the full title, date, and revision number.

Appendix A: Structure and Format of TSRs

This section provides guidance on the recommended structure and format of TSRs. Section 1 presents a suggested organization to meet the requirements of the TSR rule and provides details to assist in unifying the TSR document. Section 2 sets out the suggested content for each of the TSR sections.

1 Organization

1.1 Front Matter

Front matter should consist of the following parts. Note: all figures referred to below are found in Appendix C.

- Title page. The title page should include, at a minimum, the name of the facility, the facility location, the words “Technical Safety Requirements,” and the name of the responsible contractor.
- Table of Contents. The table of contents should list every item in the volume.
- Tables. A list of tables should be included.
- Figures. A list of figures should be included.
- Acronyms. A list of acronyms, abbreviations, and symbols should be compiled and included. An acronym, abbreviation or symbol should not be created for a name or term used only a few times in the document. When a short form reference is to be used, it should be defined on first use by means of parentheses. Thereafter, the short form of the name or term should be used.

1.2 Arrangement of Sections

The main body should include the following sections in the order indicated.

- Section 1—Use and Application
- Section 2—Safety Limits
- Section 3/4—Limiting Control Settings, Limiting Conditions for Operation, and Surveillance Requirements. Section 3 covers LCS and LCO operational limits, Section 4 surveillance requirements. These three TSR aspects are presented together to show the interconnections among them. The three-column format retains the same LCO and LCS number for related SRs.
- Section 5—Administrative Controls
- Section 6—Design Features

1.3 Appendices

Appendices appear last in the TSR document and are identified by letter. Appendix A contains the TSR bases.

2 Content

The recommended content for each section of the TSR is described in the following paragraphs.

2.1 Section 1—Use and Application

This section should contain basic information and instructions for using and applying the TSR. The following elements should be addressed under separate headings.

1. Definitions. Provide an alphabetical list of terms used throughout the TSR and their corresponding definitions (see Figure 3). Include a note on the first page of the list stating that defined terms appear in uppercase type throughout the TSR.
2. Operational Modes (Reactors). In the interest of uniformity, the operational conditions or modes listed below are preferred and an attempt should be made to fit each reactor facility into this scheme. If, however, a reactor facility cannot be made to fit, modes may be defined as needed, provided the definition is clearly written with definite lines of demarcation between modes. The number of modes should be held to a minimum. The number of modes should be established based upon the minimum number required to be able to distinguish between different facility conditions and to ensure the provision of an adequate level of safety while in each condition.

Define the operational modes for reactor facilities as follows.

- **Operation Mode.** To be in operation mode, the reactor is critical and may be at any power level up to and including maximum allowed power.
- **Start-up Mode.** To be in start-up mode, the reactor will begin in a subcritical state and be intentionally made to increase reactivity in a controlled manner to achieve a critical condition and to increase flux in an exponential manner until a low power is reached. Specific low power values are usually associated with the onset of measurable heat.
- **Standby Mode.** To be in standby mode, the reactor is subcritical but capable of operation without substantial administrative or mechanical actions. K_{eff} limits or other limits needed to define the mode should be included.
- **Shutdown Mode.** To be in shutdown mode, the reactor is significantly subcritical and capable of operation only after completing substantial administrative and/or mechanical actions. Normally, this would be a procedure or series of procedures (such as multiple system valve lineups) that should be performed, but it could be mechanical or electrical repairs, calibration, or other activity. The K_{eff} values should

normally be included, unless they are of no use for a particular reactor, in which case control rod positions or other appropriate means should be defined for “significantly subcritical.” (This is to be understood to refer to reactor shutdown, not facility shutdown.)

- **Refueling Mode.** To be in the refueling mode, the reactor vessel integrity is breached (in all non-accident conditions), or any core alterations including fuel rods, control rods, targets, or other vessel internals are occurring or have occurred. Normally this mode requires major mechanical and associated administrative steps be completed before operation is possible.

Submodes may be created and defined as needed by reactor facilities. The definitions should be clearly written with numerical or other definite demarcation between submodes. The number of submodes should be limited as much as possible to avoid complexity and potential confusion.

Normally, the definition of the modes in a TSR document will be a summary of the definitions above with whatever additional information is needed for a particular reactor.

3. Operational Modes (Nonreactor Nuclear Facilities). Modes may be defined as needed, provided the definitions are clear and there are definite lines of demarcation between modes (such as a numerical value of pressure, temperature, or flow). The number of modes should be established based on the minimum number required to distinguish between different facility conditions as dictated by required equipment operability and needed parameter limits. If a mode is not used in the LCOs (except for the safest mode) or if it doesn't have different equipment or parameter limits specified from other modes, then it shouldn't be a mode.

Define the operational modes for nonreactor nuclear facilities as follows.

- **Operation Mode.** The mission of the facility or its current campaign is being performed.
- **Start-up Mode.** The facility is operating in a transient state from shutdown or near shutdown to reach conditions in which the mission or campaign is performed. This mode is only prescribed for facilities where the procedures are complex and important to nuclear safety.
- **Shutdown Mode.** The facility is not performing its mission or its current campaign, and is incapable of doing so in its present condition. (This is to be understood to refer to a process state and not a facility shutdown.)
- **Warm Standby.** The facility is not operating but retains its inventory of hazardous material.
- **Repair Mode.** The facility is not able to perform its mission in its current condition.

Submodes may be created and defined as needed for nonreactor nuclear facility TSRs. The definitions should be clearly written with numerical or other definite demarcation between submodes. The number of submodes should be limited as much as possible to avoid complexity and potential confusion.

4. Frequency Notation. The frequency notations, as used in the surveillances and elsewhere, should be defined as follows when included in the TSR.

Notation		Minimum Frequency (periodicity notation)
S	Every shift	At least once every 12 hours
D	Daily	At least once every 24 hours
W	Weekly	At least once every 7 days
M	Monthly	At least once every 31 days
Q	Quarterly	At least once every 92 days
S/A	Semiannually	At least once every 184 days
C	Campaign	Before start-up of each campaign
R	Refueling	Before entering standby or operation modes after reactor refueling
S/U	Start-up	Before each start-up
N/A	Not applicable	Not applicable

2.2 Section 2—Safety Limits

SLs should describe as precisely as possible the process variables or the parameters being limited, and state the limit in measurable units such as degrees, gallons per minute, or psi. (See Figures 4a and 4b for examples of SLs.) In general, SLs should be monitored continuously.

SLs should be based on, and specified in terms of three rules.

Rule 1: Exceeding an SL is a TSR violation for each applicable mode. Upon exceeding an SL, the following steps should be taken:

1. The affected parameter should be immediately brought within the SL.
2. The facility should be placed in the most stable, safe condition attainable, including shutdown if appropriate.
3. Reactors should be shut down immediately - (e.g. scrammed)
4. Nonreactor nuclear facilities should be placed in the most stable, safe condition attainable, including shutdown if appropriate. The TSR should specify actions to be taken.

5. All other action requirements should be met.

Rule 2: Each SL should have a mode applicability statement. This statement identifies the modes or other conditions for which the SL is applicable.

Rule 3: Action statements should describe the actions to be taken in the event that the SL is not met.

In regard to Rule 3, specified actions should:

- place the facility in a safe, stable condition and verify that this condition has been achieved;
- establish the steps and time limits to correct the out-of-specification condition; and
- bring the affected parameter immediately within the SL and should affect a shutdown of the facility, within a justified facility-specific time frame, normally less than an hour.

Other actions required after exceeding an SL, including reporting the event and evaluating possible damage, may be included in the action statement or may be placed in Section 5, “Administrative Controls,” with a suitable cross-reference. A statement prohibiting restart of operations until DOE approval is received should be included in the action statement of each SL and in Section 5 of the TSR.

2.3 Section 3/4—Limiting Control Settings, Limiting Conditions for Operation, and Surveillance Requirements¹

This section contains LCSs, LCOs, and SRs. Mode and location applicability statements and action statements should also be included for each LCO or LCS, as appropriate.

Limiting Control Settings. LCSs should describe, as precisely as possible (a) the parameter or process variable being controlled or equipment being actuated and (b) the limiting settings of control devices. This information may be presented in tabular or graphic form, with necessary written information placed in the body of the requirement. The LCS or an associated LCO should specify the allowed out-of-service time permitted when testing, resetting, repairing, or maintaining trip devices, and similarly specify the allowed outage time for associated equipment that must be removed from service for these activities.

LCSs should be based on three rules:

Rule 1: Compliance with an LCS is required in the modes specified.

¹ Section 3 delineates LCS and LCO operational limits. Section 4 describes SRs. There is usually a one-to-one correlation between LCS and LCO operational limits and the surveillances related to them. The combined TSR section is designated Section 3/4.

Rule 2: Upon discovery that the instrumentation or interlock set point is less conservative than the required LCSs, the associated action should require that it be reset. Other requirements such as allowable outage times should be specified.

Rule 3: If an automatic safety system is not operable as specified, the action statement should describe the appropriate action to restore the affected system to an operable condition as well as compensatory measures while the automatic safety system is out of service. The LCS should specify the allowed out-of-service time permitted when testing, resetting, repairing, or maintaining trip devices and similarly the time permitted for associated equipment to be removed from service for these activities.

Figure 5 provides an example of a LCS.

Limiting Conditions for Operation. The LCO statement should describe, as precisely as possible, the lowest functional capability or performance level of equipment required for safe operation of the facility. Each separate limiting condition should have an LCO with associated mode applicability, action statements, and SRs.

This part should contain the requirements for how LCOs should be applied. LCOs should be based on and specified according to three rules.

Rule 1: Compliance with an LCO is required in the modes specified.

Rule 2: The LCO must include an AOT to attempt restoration of operability.

Rule 3: Upon failure to meet an LCO, the associated action requirement must be met.

In addition to these rules, the following guidance should be considered.

Applicability Statements. For each LCS and LCO, the applicability statement should list the modes or conditions for which the LCS or LCO is applicable.

Action Statements. An action statement should describe the actions to be taken in the event that an LCS is exceeded or an LCO statement is not met. Action statements must include the AOT to attempt to restore operability. Whenever possible, action statements should be divided into separate sections, each describing a single deviated condition requiring operator action. This format simplifies the explanation of the expected action and better ensures that the action will be performed correctly. Completion times for each action should be stated in simple units of time such as minutes or hours.

Use the term “OPERABLE” to describe the corrected condition or part of the system without deviation. (While “inoperable” is presented in lowercase letters, operable is presented in uppercase letters.) Keep wording in action statements as brief as possible. Be consistent in the use of verbs and tense. Use the same wording structure when specifying requirements. Do not use articles unless necessary for clarity. When a mode change is required by an action statement, it is preferable to use the actual title of the modes (i.e., rather than numerical designation of modes) to avoid a misunderstanding or a typographical error that could cause the operator to take inappropriate action. Action statements should cover all reasonably expected combinations of

operable and inoperable components in the systems described. Generic LCOs can cover the conditions not called out in individual action statements.

Surveillance Requirements. SR statements are descriptions of the type of surveillance required and its frequency of performance. These should identify those requirements needed to ensure compliance with the LCS or LCO. SRs are requirements relating to test, calibration, or inspection that ensure the necessary operability and availability of safety-related SSCs. Surveillance should be based on the following three rules.

Rule 1: SRs must be met for all safety-related SSCs for the facility to be considered operable.

Rule 2: Each SR should be performed at the specified frequency, with a maximum extension of 25 percent of the interval between any two consecutive surveillances. (This extension is intended to provide operational flexibility both for scheduling and for performing surveillances. It should not be relied upon as a routine extension of the specified interval.)

Rule 3: Special test exceptions to TSRs may be allowed under controlled conditions. These test exceptions should be placed in Section 3 (LCO). Any test exception should explain which LCOs are affected, for how long, and what compensatory measures (such as enhanced supervision) will be taken.

2.3.1 Section 4—Administrative Controls

This section imposes administrative requirements necessary to ensure TSR compliance. The paragraphs that follow discuss some of the ACs that should be placed in this section.

Contractor Responsibility. The facility or plant manager is responsible for overall operation of the nuclear facility and should delegate in writing the succession to this responsibility during his or her absence. The shift supervisor is responsible for the local command function. During any absence of the shift supervisor from the area, a designated, qualified individual should be assigned the command function.

Contractor Organization. On-site and off-site organizations should be described for facility operation and contractor management. The on-site and off-site organizations should be described in terms of the lines of authority, responsibility, and communication for the highest management levels through intermediate levels to and including all operating organization positions. The individuals who train the operating staff and those who carry out health physics and quality assurance functions may report to the appropriate on-site manager; however, they should have sufficient organizational freedom to ensure their independence from operating pressures.

Procedures. Operations procedures should provide sufficient direction to ensure that the facility is operated within its approved design basis. Topics that should be considered for coverage include:

- Operating procedures for all modes of operations,
- Emergency Operating Procedures,
- Maintenance Requirements,
- Required surveillances,

- Security plans,
- Emergency plans,
- Fire protection,
- Safety Management Program Implementation procedures; and
- Administration.

A system should be developed to control all procedures related to TSR compliance. The system should include mechanisms for review, approval, revision, control, and temporary changes to the procedures. The TSRs refer to the control system adopted.

Programs. Programs developed to ensure the safe operation of the facility should be discussed and committed to by reference. Such programs should include (1) in-service inspection of components, pumps, and valves as per ASME Boiler and Pressure Vessel Code Section XI, (2) worker protection (such as radiation protection), (3) process control, (4) ventilation filter testing, (5) explosive gas and storage tank radioactivity monitoring, (6) radiological effluent control, (7) quality assurance, (8) criticality safety, (9) configuration control, and (10) document control.

The basic elements of these programs should be described in this section, but the details and implementing processes for each program should be placed in separate controlled volumes and are not to be included in the TSR.

Minimum Operations Shift Complement. This section of the ACs should state the maximum daily working hours and maximum number of consecutive days on duty.

The required total staffing of operating shifts for nonreactor nuclear facilities, and the members of the shift staff required to be present in the control room or control area for different operating conditions, should be specified based on the safety analysis.

Operating Support. A list of facility support personnel by name, title, and work and home telephone number must be kept up to date. The list should include management, radiation safety, and technical support personnel. The list should be referenced in the TSR and made readily accessible to operating personnel.

Facility Staff Qualifications and Training. Minimum qualifications for members of the facility staff in positions affecting safety should conform to the requirements of DOE Order 426.2 or successor document. These requirements should be referenced in the AC section.

Recordkeeping. Records need to be kept of all information supporting the implementation of the TSR. To this end, a records retention program should be established that determines which records are to be kept, in what format, for how long, and under what security.

Reviews and Audits. This section describes the methods used to conduct independent reviews and audits of facility TSRs. Methods may include creating an organizational unit, a standing or ad hoc committee, or assigned individuals capable of conducting these reviews and audits. Individual reviewers should not review their own work or work for which they have direct responsibility. Regardless of the method used, management should specify the functions,

organizational arrangement, responsibilities, appropriate qualifications, and reporting requirements of each functional element or unit that contributes to these processes.

Reviews and audits of activities affecting facility safety have two distinct elements. The first of these is the review performed by facility personnel to ensure that day-to-day activities are conducted in a safe manner consistent with the TSRs. The second is the review and audit of activities and programs affecting nuclear safety performed independently of the facility staff.

Facility staff reviews should include: TSR changes, USQ determinations, proposed tests and experiments, procedures, programs, facility changes and modifications, facility operation, maintenance, and testing; DOE and industry issues of safety significance; and any other safety-related items.

Reviews by the off-site safety organization should include these same items and in addition: conformance with TSRs, violations of codes, orders, and procedures that have safety and health significance, Occurrence Reports, staff training, qualifications and performance, quality assurance program adherence, unanticipated deficiencies of SSCs that could affect nuclear safety, significant, unplanned radiological or toxic material releases, and significant operating abnormalities.

2.3.2 Section 5—Design Features

The purpose of a design features section is to describe in detail features not covered elsewhere in the TSRs that, if altered or degraded, would have a significant effect on safety. The following two areas should be addressed in this section: (1) vital passive safety SSCs such as piping, vessels, supports, structures (such as confinement), and containers, and (2) configuration or physical arrangement of SSCs. For each design feature covered, the discussion should address the specific parameters being controlled and the technical basis for the importance of these parameters. One example might be the need to maintain the configuration and physical separation of stored materials to avert a criticality event.

2.3.3 Bases Appendix

This appendix provides technical reasoning behind the SLs, LCSs, LCOs, and SRs. The bases show how the numeric values, conditions, surveillances, and action statements fulfill the purpose derived from the safety documentation. The primary purposes for describing the bases of each requirement are to (a) ensure that future changes to the requirement will not adversely affect its original intent or purpose, and (b) aid in understanding why the requirement exists. The bases appendix should reference relevant sections of the safety analyses.

2.4 Format

The TSR document must be usable by the operations staff and at the same time understandable by DOE and contractor managers charged with review responsibilities. To meet both of these objectives, a suggested format is provided in the following sections. This standardized format should minimize the burden on oversight organizations and make any necessary training of operations staff easier.

DOE recognizes, however, that wholesale changes in TSR documentation for the sake of consistency may be costly and produce no balancing safety benefit. Thus, DOE will approve TSRs in other formats if the contractor provides adequate justification and the requirements of 10 CFR Part 830 are met. In particular, the three-column format provides an advantage in terms of clarity for the operator and is strongly suggested (but not required) for those facilities with complex operations and many safety or operational limits.

2.4.1 Numbering of Pages, Sections, Tables, and Figures

Page Numbering. All page numbers should be centered at the bottom of the page. The following paragraphs describe the page numbering schemes for individual sections of the TSR.

- Front Matter Pages. Number the front matter pages with successive lowercase Roman numerals (i, ii, iii, etc.).
- Section Pages (except Sections 2 and 3/4). All section page numbers, except for Sections 2 and 3/4, should have two parts: an Arabic number for the section, followed by a dash, and an Arabic number designating the numerical page number within the section. For example, pages in Section 1 would be numbered 1-1, 1-2, 1-3, etc.; likewise, pages in Section 5 would be numbered 5-1, 5-2, 5-3, etc.
- Sections 2 and 3/4 Pages. Sections 2 and 3/4 are subdivided into numerous subsections corresponding to the individual requirement numbers. The first part of each page number for Sections 2 or 3/4 should, therefore, correspond to the subsection number. This subsection number should be followed by a dash and an Arabic number designating the numerical page number within the subsection (e.g., 2.1.1-1, 3/4.1-1); see also the examples in the figures found in Appendix B of this guide).
- Appendix Pages. Number all pages of appendices, except for the bases appendix, with an alphanumeric number consisting of the appendix letter and the sequential page number separated by a dash.
- Bases Appendix Pages. All page numbers for the bases appendix should begin with the word “Bases” followed by the section number for the particular section the basis supports (see examples below).
 - —Bases 2.1-1, Bases 2.1-2, . . .
 - —Bases 3/4.0-1, Bases 3/4.0-2, . . .
 - —Bases 3/4.1-1, Bases 3/4.1-2, . . .

Paragraph Numbering for Sections 1, 5, and 6. Paragraphs should be numbered hierarchically with successive Arabic numerals separated by decimal points. The following scheme should be used for subordination of paragraphs.

- 1.1 Major Paragraph

- 1.1.1 First Subordinate Paragraph
- 1.1.1.1 First Subdivision of First Subordinate Paragraph
- 1.2 Second Major Paragraph

Numbering for Sections 2 and 3 (Safety Limits, Limiting Control Settings, and Limiting Conditions for Operation). All SLs, LCSs, and LCOs should begin with either 2 or 3, then the number associated with the group, which will be followed by the number of the requirement, per the following examples. (Complex systems may require further subdivision.)

- 2.11 Reactor Coolant Circulation System
- 3.10.2.1 Diesel Generator Fuel Oil Tank
 - Number SLs beginning with 2.1 and continuing with 2.2, 2.3, etc. Any subdivision of SLs should be numbered with an additional number added to the number of the SL; for example, 2.1.1, 2.1.2, etc.
 - Number OLs beginning with 3.1 and continuing with 3.2, 3.3, etc. Any subdivisions of OLs should be numbered with an additional number added to the number of the LCS (e.g., 3.2.2, 3.2.3, 3.2.4). OLs should be grouped by principal system or function and each OL within a group should be numbered sequentially. LCSs are normally the first requirements within a group. For reactors, normally all OLs can be put into the following groups:
 - Limiting Condition for Operability
 - Reactivity Control
 - Core Power Distribution
 - Instrumentation
 - Coolant System
 - Safety Systems
 - Confinement/Containment
 - Plant Systems
 - Electrical Systems
 - Experiment Facilities
 - Rad Waste Systems
 - Special Tests
 - Refueling Requirements
 - Spent Fuel Pool Requirements

For less complex reactor facilities, omit any inappropriate groups above but retain the same numbering scheme to indicate that a group was omitted. Add other groups as necessary.

For nonreactor nuclear facilities, standardized grouping of requirements is more difficult because of the diversity of facilities; however, many facilities will have the following.

- Limiting Condition for Operability
 - Criticality, Radioactivity, and Hazardous Material Alarm Systems
 - Confinement/Ventilation
 - Fire Detection and Suppression
 - Emergency Power
 - Chemical Systems
 - Instrumentation
 - Experimental Facilities
- For less complex nonreactor facilities, omit any inappropriate groups above but retain the same numbering scheme to indicate that a group was omitted. Add other groups as necessary.
 - action statements should be lettered with uppercase letters. Subdivisions of action statements should be numbered 1, 2, 3, etc.

Numbering for Section 4 (Surveillance Requirements). SRs should be designated with numbers beginning with 4. The second number should correspond to the grouping scheme used for the LCS or the LCO, and the third number in the sequence indicates the LCS or the LCO that this surveillance principally supports. Hence, the SRs will have numbers the same as the LCS or the LCO that they support except for the first number, which will be a “4” instead of a “3.” Subdivisions should be identified with a lowercase letter and indented; further subdivisions should be labeled consecutively with a number enclosed in parentheses [e.g., (1), (2)] and should be indented from the letter.

Numbering Bases (Bases Appendix). Bases are numbered in accordance with the number of the SL, LCS, or LCO that they support.

Numbering Tables. All tables should be located as close as possible after the place where they are first referenced. Where tables and figures are both referenced in a specification, present the tables before the figures. Table numbers in Sections 2 and 3/4 should begin with the number of the specification to which they apply, followed by a dash, and then sequential Arabic numerals.

Example Table Numbers for Section 3/4

Table 3.3.1-1. Title

Table 4.2.5-1. Title

Numbers of tables in the bases appendices should begin with the words “Bases Table” and the subsection number that they support, followed by a dash and then sequential Arabic numbers.

Example Table Numbers for Bases Appendix

Bases Table 3/4.1-1. Title

Bases Table 3/4.2-1. Title

Table numbers in all other sections should begin with the applicable section number followed by a dash and then sequential Arabic numbers.

Example Table Numbers for Sections Other Than Bases and Sections 2 and 3/4

Table 5-1. Title, (Sheet 1 of 6)

Table 5-2. Title

For multiple-page tables in all sections, use the phrase (Sheet 1 of __, Sheet 2 of __, etc.) after the table title (see example above).

Numbering Figures. All figures should be located as near as possible after the place where they are first referenced. Figure numbers in Sections 2 and 3/4 should begin with the number of the requirement to which they apply, followed by a dash, then sequential Arabic numbers.

Example Figure Numbers for Section 3/4

Figure 2.1.1-1. Title

Figure 3/4.2.1-1. Title

Figure 3/4.2.5-1. Title

Figure numbers in the bases appendixes should begin with the words “Bases Figure” and the subsection number that they support, followed by a dash and then sequential Arabic numbers.

Example Figure Numbers for Bases Appendix

Bases Figure 2.1-1. Title.

Bases Figure 3/4.2-1. Title.

Figure numbers in all other sections should begin with the applicable section number followed by a dash and then sequential Arabic numbers. For multiple-page figures in all sections, use the phrase (Sheet 1 of __, Sheet 2 of __, etc.) after the figure title.

Example Figure Numbers for Sections Other Than Sections 2 and 3/4 and Appendix

Figure 5-1. Title, (Sheet 1 of 6).

Figure 5-2. Title.

2.4.2 Page Headings

Use uppercase letters in the page headings for consistency and to set the headings apart from the body text. Separate the heading information from the body of the requirement by a solid horizontal line across the entire page (see Figures 9a and 9b).

Example 1.

3/4.4 REACTOR COOLANT SYSTEM

3.4.2 PRESSURE PROTECTION SET POINTS

Example 2.

3/4.6 CONFINEMENT SYSTEMS

3.6.2 AIR CLEANING SYSTEM

2.4.3 Continuation Pages

Use the word “continued” in parentheses and in lowercase letters to denote continuation of a grouping of action statements, surveillances, or bases to the next page (see Figures 13 and 15).

Example 3.

3/4.6 CONFINEMENT SYSTEMS

4.6.1 SURVEILLANCE REQUIREMENTS (continued)

2.4.4 Highlighting

Various forms of highlighting may be used to improve visibility of the information presented. These include the following.

Bolding. Bold type may be used to highlight the major headings, table column headings, and to emphasize especially important information. Notes can also be in bold type for added emphasis.

Spatial Dedication. The SL, LCS, and LCO requirements may be offset or indented so that this information stands out from the surrounding text. Recognition and separation of the SL, LCS, and LCO requirements allows this information to be more quickly and easily located and scanned without interference from the surrounding text. Also, the SL, LCS, and LCO mode applicability headings may be separated by extra “white space” (blank lines), allowing for quick recognition and scanning of specific information.

Delimiters. Delimiters function as visual cues for the user, signaling the beginning and/or end of specific segments of information (two independent requirements on the same page, for example). Delimiters may take the form of two closely spaced horizontal lines, one dark, heavy line, a series of dark dashes, or any similar prominent marking.

Underscoring. Underscoring is an effective way of adding emphasis to specific information, when properly used; however, it tends to lose its effectiveness when used too much. For this reason, underscoring should be used only to add emphasis to logical connectors (AND, OR, etc.).

2.4.5 Use of Logic Terms (AND, OR, IF, BUT, etc.)

The following guidelines apply.

- All logic terms should be underscored, in uppercase bold type, and flush left between the two (or more) sets of connected conditions to which they apply.
- AND should be used to connect two or more sets of criteria that must both (all) be satisfied for a given logical decision. If more than two sets of conditions are required, a list format is preferable.
- OR should be used to denote alternative combinations or conditions, meaning either one or the other.

When action steps are contingent upon certain conditions, terms such as IF, BUT, IF NOT, may be used as appropriate.

2.4.6 Notes and Cautions

Notes and cautions should not normally occur within the context of the TSR. The TSR in itself is a compendium of potential cautions, and notes often indicate that the basic explanation is inadequate. When notes or cautions are necessary, the following apply.

- Cautions should precede the information to which they refer, with no other intervening information. Notes may be placed before or after the text they amplify, whichever is most appropriate. All notes and cautions should be preceded by the centered heading “**NOTE**” or “**CAUTION**” in uppercase, bold type. Text in the note or caution statement should be in bold type, indented from both sides of the page. Cautions should be delimited from standard text.
- Notes and cautions pertaining to information inside the action and SR statements should be placed before the information to which they apply, with no other intervening information.

2.4.7 Tables

When the volume of tabular information to be presented is small, consider integrating the information in text rather than using a separate table. When tables are necessary, they should be located as conveniently as possible for the user. They should have a formal title and number.

2.4.8 Body of Section 1—Use and Application

This section is expected to be mostly text, so it should take the form of paragraphs numbered in accordance with Section 5.3.1. Other forms of input should follow the guidance outlined in Section 5.3.

2.4.9 Body of Section 2—Safety Limits

SLs should be presented in a single-column or three-column format.

The page heading, as described in Section 4.3.2, should be to the left margin of the page. The SL, denoted by the acronym SL, should follow, separated by at least one blank line from other text (see examples in the figures that follow this section). If the requirement has subdivisions, they should follow on separate lines and be indented.

Below the requirement, with sufficient space left above to make the requirement stand apart, the word “**APPLICABILITY**” should appear at the left margin, in bold uppercase letters, followed by a colon (also bold). On the same line should be the applicability modes or other conditions.

Below the applicability statement, separated by at least one blank line, the word “**ACTIONS**,” in bold, uppercase letters, followed by a bold colon, should appear. The action statements should follow, indented from the left margin and labeled with capital letters. Subdivisions of the action statements should be further indented and numbered.

2.4.10 Body of Section 3/4—Limiting Control Settings, Limiting Conditions for Operation, and Surveillance Requirements

Figures 6 through 16 provide examples of the way information for Section 3/4 should be presented. The page headings should be as described in Section 4.3.2 and should be to the left-hand margin of the page. Below the heading and indented should be the letters “LCS” or “LCO” in bold uppercase letters. This should be followed on the same line by a colon and then the requirement. For simple requirements a sentence or two may suffice, while for a complex requirement subdivisions may be necessary. Use uppercase letters for the main divisions and indented numbers as the first subcategory. Use indented lowercase letters for the next division, if necessary. If further division appears to be necessary, consider making an entire new requirement within the main group.

Below the requirement, separated by at least one blank line, the word “**APPLICABILITY**” should appear at the left margin, in bold, uppercase letters. On the same line should be the applicability modes or other conditions.

Below the applicability statement, again, separated by at least one blank line, should appear the word “**ACTIONS**” in bold, uppercase letters. The action statements should follow. The main divisions and subdivisions of the action statements should be numbered/lettered according to conventional outlining practices or as described above for requirements.

SRs should follow the action statements, separated by at least one blank line. They should be labeled by the title (**SURVEILLANCE REQUIREMENTS**) in bold, uppercase letters. The surveillance statement should include the surveillance number; a statement of the requirement (with indented subdivisions, if necessary); and an indication of the frequency. Examples of the suggested format for SRs are given in Appendix B. Additional examples of the three-column format have been developed by DOE for specific types of SSCs and are available in the Defense Programs TSR Document of Examples, Technical Safety Requirements, November 1993.

2.4.11 Body of Sections 5 and 6—Administrative Controls and Design Features

These sections are expected to be mostly text, possibly with tables, so they should take the form of paragraphs numbered in accordance with Section 4.3.1 of this Guide.

2.4.12 Body of Bases Appendix

The body of the bases appendix should be presented in the format shown in Figure 21. The page heading should be that described in Section 4.3.2, with the number of the SL, LCS, or LCO and the same title used in that requirement. Below the requirement number and title (B3/4.4 PRESSURE LIMITS in Figure 21, for example), the word **BASES** in bold, uppercase letters should be at the left margin, followed by a delimiter and the bases themselves.

2.5 Changes to Technical Safety Requirements

Changes to the TSR should be designated in the following manner:

- a list of pages in effect with page number and date,
- a record of revision pages,
- sidebar changes in the TSR text, and
- for each altered page, the page number, document number, and revision number.

Appendix B: TSR Examples

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Figure 2. Example Table of Contents for a Nonreactor Nuclear Facility TSR.

DEFINITIONS

ACTION. The steps listed in each requirement that are required to be performed when the specified LIMITING CONDITIONS FOR OPERATION are not met.

ACTUATION LOGIC TEST. The application of various simulated input signal combinations in conjunction with each possible interlock logic state and verifying the required logic output. Will include, as a minimum, a continuity check of output devices

ANALOG CHANNEL OPERATIONAL TEST. Injection of a simulated signal into . . .

CALIBRATION The adjustment (as necessary) of the output such that it meets established acceptance criteria (e.g., responds within the necessary range and accuracy to known values). The CALIBRATION SHALL encompass the sensor, alarm, and trip functions, and SHALL be checked by a FUNCTIONAL TEST.

CHANNEL The combination of sensor, line, amplifier, and output devices that are connected for the purpose of measuring the value of a parameter and providing a signal for actuation.

COMPLETION TIME The amount of time allowed for completing an ACTION. See Section 1.3.

CONDITION A discrete degradation of a system or component in which an ACTION is performed within a specified COMPLETION TIME.

ENSURE To confirm, substantiate, and assure that an activity or CONDITION has been implemented in conformance with the specified requirements. Allows for manipulation of equipment or instrumentation to conform with specified requirements. May be done by reliable methods other than direct observation.

FUNCTIONAL TEST Tests OPERABILITY, including required alarms, interlock(s), trip functions, and CHANNEL failure trips (e.g., the injection of a simulated or actual signal into the CHANNEL as close to the sensor as practical). In contrast to VERIFICATION, this FUNCTIONAL TEST is an active test of the system.

IMMEDIATE/ IMMEDIATELY Term used as a COMPLETION TIME for ACTION statements when a step is to be initiated as soon as possibly achievable without creating a less safe condition, and continuously and aggressively pursued until complete.

SAFE CONFIGURATION Condition resulting from the minimization of risk in on-going processes commensurate with the chemical and/or physical form of material and/or arrangement of material and/or equipment.

SHALL Denotes a mandatory requirement that must be complied with to maintain the requirements, assumptions, or conditions of the facility SAFETY BASIS.

TERMINATE Means to stop an operation or activity as quickly and safely as possible.

Figure 3. Example Definitions List.

2.1 SAFETY LIMITS**2.1.1 REACTOR COOLANT SYSTEM (RCS) PRESSURE SAFETY LIMIT****SL:** The RCS shall be maintained < 1000 psia**APPLICABILITY:** Operation Mode

ACTIONS:

1. Go to SHUTDOWN mode IMMEDIATELY,
2. Notify the DOE CSO within one hour of reaching SHUTDOWN mode, and
3. Prohibit facility operation until authorized by DOE.

Figure 4a. Example of Safety Limit for a Nuclear Reactor Facility.**2.1 SAFETY LIMITS****2.1.1 REACTOR COOLANT SYSTEM (RCS) PRESSURE SAFETY LIMIT****SL:** The RCS shall be maintained < 1000 psia**MODE APPLICABILITY:** Operation Mode**ACTIONS:**

CONDITIONS	REQUIRED ACTION	COMPLETION TIME
A. The RCS exceeds the Safety Limit (1000 psia).	A.1. Go to SHUTDOWN mode.	IMMEDIATELY
	<u>AND</u>	
	A.2. Notify the DOE CSO.	Within one hour of reaching SHUTDOWN mode
	<u>AND</u>	
	A.3. Prohibit facility operation.	Until authorized by DOE

Figure 4b. Example of Safety Limit for a Nuclear Reactor Facility in Three-Column Format.

3/4.4 LIMITING CONTROL SETTINGS**3/4.4.3 COOLANT PRESSURE****LCS:** Maintain Coolant system below 100 psia**MODE APPLICABILITY:** All Modes.**ACTIONS:**

CONDITION	REQUIRED ACTION	COMPLETION TIME
Pressure > 100 psia	Open Relief Valve	15 minutes
SURVEILLANCE REQUIREMENTS		
SURVEILLANCE REQUIREMENT		FREQUENCY
SR 3/4.2.3.1 Verify Pres. < 100 psia		Every shift
SR 3/4.2.3.2 Verify Pres. Relief Set Point = 95 +/- 4 psia		Every shift

Figure 5. Example of Limiting Control Settings in Three-Column Format.

3/4.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)**3/4.5.2 ECCS-OPERATING****LCO:** Two ECCS trains shall be OPERABLE**MODE APPLICABILITY:** MODES 1 and 2
MODE 3 with pressurizer pressure < [1700] psia.**ACTIONS:**

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more trains inoperable. <u>OR</u> At least 100% of the ECCS flow equivalent to a single OPERABLE ECCS train is available.	A.1 Restore train(s) to OPERABLE status.	72 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3. <u>AND</u> B.2 Reduce pressurizer pressure to < [1700] psia.	6 hours 12 hours

Figure 6. Example of LCO in Three-Column Format.

GENERAL LIMITING CONDITIONS FOR OPERATION (LCOS) 3.0.X

LCO 3.0.1	LCOs shall be met during the MODES or other specified conditions in the Applicability, except as provided in LCO 3.0.2.
LCO 3.0.2	Upon discovery of a failure to meet an LCO, the associated ACTIONS shall be met. If the LCO is restored before the specified completion time(s) expires, completion of the ACTION is not required, unless otherwise stated.
LCO 3.0.3	<p>When an LCO statement is not met and the associated ACTIONS are not met, or when an associated ACTION is not provided, the facility shall be placed in a MODE or other specified condition in which the LCO is not applicable. If the LCO is applicable in all MODES, the facility shall be placed in the safest MODE. Activities shall be initiated to place the affected PROCESS AREA(S) or facility in STANDBY within 1 hour. The affected PROCESS AREA or facility shall be in STANDBY within 12 hours.</p> <p>Where corrective measures are completed that permit operation in accordance with the LCO or ACTIONS, completion of the ACTIONS required by LCO 3.0.3 are not required.</p> <p>LCO 3.0.3 is applicable in all MODES. Exceptions to LCO 3.0.3 may be stated in the individual LCOs.</p>
LCO 3.0.4	<p>When an LCO is not met, a MODE or other specified condition in the Applicability shall not be entered, except when the associated ACTIONS to be entered permit continued operation in the MODE or other specified condition in the Applicability for an unlimited period of time. LCO 3.0.4 shall not prevent changes in MODES or other specified conditions in the Applicability that are required to comply with ACTIONS.</p> <p>Exceptions to LCO 3.0.4 are stated in the individual LCOs. When an individual LCO states that LCO 3.0.4 does not apply, it allows entry into MODES or other specified conditions in the Applicability when the associated ACTIONS to be entered permit operation in the MODE or other specified condition for only a limited time.</p>
LCO 3.0.5	Equipment removed from service or declared inoperable to comply with ACTIONS may be returned to service under administrative control solely to perform testing required to demonstrate its OPERABILITY or the OPERABILITY of other equipment. This is an exception to LCO 3.0.2 for the system returned to service under administrative control to perform the testing required to demonstrate OPERABILITY.
LCO 3.0.6	When a support system is declared inoperable, the supported systems are also required to be declared inoperable. However, only the support system's ACTIONS are required to be entered, provided they reflect the supported system's degraded safety condition. This is a clarification of the definition of OPERABILITY.

Figure 7a. Example of General Application LCOs.

4.0.X GENERAL SURVEILLANCE**3/4 OPERATING LIMITS AND SURVEILLANCE REQUIREMENTS****3/4.0 GENERAL APPLICATION****SURVEILLANCE REQUIREMENTS**

- 4.0.1 SURVEILLANCE REQUIREMENTS shall be met during the Operational Modes or other conditions specified for individual LCS and LCOs unless otherwise stated in an individual SURVEILLANCE REQUIREMENT.
- 4.0.2 Each SURVEILLANCE REQUIREMENT shall be performed with the specified frequency.
- 4.0.3 Failure to perform a SURVEILLANCE REQUIREMENT within 1.25 times the specified time interval (TSR violation) shall constitute a failure to meet the OPERABILITY requirements for a LIMITING CONDITION FOR OPERATION. Exceptions are stated in the individual requirements. Surveillances do not have to be performed on inoperable equipment.
- 4.0.4 Entry into an Operational Mode or other specified condition shall not be made unless the SURVEILLANCE REQUIREMENT(S) associated with the LIMITING CONDITION FOR OPERATION has been performed within the stated surveillance interval or as other otherwise specified.

Figure 7b. Example of General Application for Surveillance.

SURVEILLANCE REQUIREMENTS		
SURVEILLANCE REQUIREMENT		FREQUENCY
SR 3/4.5.10.1	Verify each pressurizer safety valve is OPERABLE as per In-service Testing Program. After testing, lift settings must be within 1%.	Every shift

Figure 7c. Example of Surveillance Requirements in Two-Column Format.

3/4.3 FIRE DETECTION AND SUPPRESSION**3.3.1 FIRE DETECTION INSTRUMENTATION**

LCO: The fire detection instrumentation, associated isolation damper interlocks, and alarm system for each fire area in Table 3.3.1-1 shall be OPERABLE.

AND

At least half of the total fire detectors in a fire area shall be OPERABLE.

MODE APPLICABILITY: OPERATION, STANDBY, PARTIAL SHUTDOWN, FULL SHUTDOWN, and OUTAGE

PROCESS AREA APPLICABILITY: [area 1]

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. More than half of the total fire detectors in a fire area are inoperable.	A.1 Restore the inoperable fire detectors to OPERABLE status.	14 days
B. The ACTION and associated completion time of Condition A are not met. <u>OR</u> Two or more adjacent fire detectors in a fire area are inoperable.	B.1 Establish a fire watch patrol to inspect the area(s). <u>AND</u> B.2 Inspect the area(s).	1 hour Hourly
C. Any fire alarm or isolation damper interlock is inoperable.	C.1 Establish a fire watch patrol to inspect the area(s). <u>AND</u> C.2 Inspect the area(s).	15 minutes Hourly

Figure 8. Example of Fire Detection Instrumentation LCOs.

3/4.3 FIRE DETECTION AND SUPPRESSION**3.3.1 FIRE DETECTION INSTRUMENTATION (continued)****SURVEILLANCE REQUIREMENTS**

SURVEILLANCE REQUIREMENT		FREQUENCY
SR 4.3.1.1	Perform a TRIP ACTUATING DEVICE OPERATIONAL TEST on each fire detector instrument.	Semiannually
SR 4.3.1.2	Demonstrate that the NFPA Standard 72D supervised circuits supervision associated with the detector alarms of each fire detection instrument are OPERABLE.	Semiannually
SR 4.3.1.3	Demonstrate that the unsupervised circuits associated with the detector alarms between the instrument and the control room are OPERABLE.	Monthly

Figure 9a. Example of Fire Detection Instrumentation Surveillance Requirements.

3/4.3 FIRE DETECTION AND SUPPRESSION**3.3.1 FIRE DETECTION INSTRUMENTATION (continued)**

**TABLE 3.3.1-1. Fire Detection Instruments
(for areas taken credit for in the safety analysis)**

Sheet 1 of 2

Instrument Location [Illustrative]	<u>Total Number of Instruments</u>		
	<u>Heat</u>	<u>Flame</u>	<u>Smoke</u>
1. Primary Containment			
a. Zone 1			
b. Zone 2			
c. Zone 3			
2. Secondary Containment			
a. Zone 1			
b. Zone 2			
c. Zone 3			
3. Tertiary Containment			
a. Zone 1			
b. Zone 2			
c. Zone 3			
4. Gloveboxes			
a.			
b.			
c.			
5. Hot Cells			
a.			
b.			
c.			
6. Ventilation Ducts			
a.			
b.			
c.			

Figure 9b. Example of Fire Detection Instrumentation Surveillance Requirements.

3/4.3 FIRE DETECTION AND SUPPRESSION**3.3.1 FIRE DETECTION INSTRUMENTATION (continued)**

TABLE 3.3.1-1. Fire Detection Instruments
(for areas taken credit for in the safety analysis) (continued)

Sheet 2 of 2

Instrument Location [Illustrative]		<u>Total Number of Instruments</u>		
		<u>Heat</u>	<u>Flame</u>	<u>Smoke</u>
7.	Battery Room			
	a.			
	b.			
	c.			
8.	Diesel Generators			
	a. Zone 1			
	b. Zone 2			
	c. Zone 3			
9.	Engineered Safety Feature Cubicles(s)			
	a.			
	b.			
	c.			
10.	Safety-Related Instrumentation			
	a.			
	b.			
	c.			

[List all detectors in area required to ensure the OPERABILITY of safety-related equipment]

**Figure 9b. Example of Fire Detection Instrumentation Surveillance Requirements
(continued).**

3/4.3 FIRE DETECTION AND SUPPRESSION

3.3.2 FIRE SUPPRESSION WATER SYSTEM

LCO: The Fire Suppression Water System shall be OPERABLE with—

- a. At least [two] fire suppression pumps, each with a capacity of [2500] gpm, with their discharge aligned to the fire suppression header
- b. Separate water supplies, each with a minimum usable volume of [] gallons
- c. An OPERABLE flow path capable of taking suction from the [] tank and the [] tank and transferring the water through distribution piping with OPERABLE sectionalizing control or isolation valves to the yard hydrant curb valves, the last valve ahead of the water flow alarm device on each sprinkler or hose standpipe, and the last valve ahead of the deluge valve on each Deluge or Spray System required to be OPERABLE in accordance with LCO 3.2.5.

MODE APPLICABILITY: OPERATION, STANDBY, PARTIAL SHUTDOWN, FULL SHUTDOWN, and OUTAGE

PROCESS AREA APPLICABILITY: [area 2]

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One pump and or water supply is inoperable.	A.1.1 Restore the inoperable equipment to OPERABLE status.	5 days
	<u>OR</u> A.1.2 Provide an alternative backup pump or supply.	7 days
B. The Fire Suppression Water System is inoperable for reason other than those in Condition A.	B.1 Provide a backup Fire Suppression Water System.	24 hours

Figure 10. Example of Fire Suppression Water System LCO.

3/4.3 FIRE DETECTION AND SUPPRESSION**3.3.2 FIRE SUPPRESSION WATER SYSTEM (continued)****SURVEILLANCE REQUIREMENTS**

SURVEILLANCE REQUIREMENT		FREQUENCY
SR 4.3.2.1	Verify that the contained water supply volume contains [] gallons.	Weekly
SR 4.3.2.2	On a STAGGERED TEST BASIS, start each electric motor-driven pump, and operate it for at least 15 minutes on recirculation flow.	Monthly
SR 4.3.2.3	Verify that each valve (manual, power-operated, or automatic) in the flow path is in its correct position.	Monthly
SR 4.3.2.4	Verify that a system flush was performed.	Semiannually
SR 4.3.2.5	Cycle each testable valve in the flow path through at least one complete cycle of full travel.	Annually
SR 4.3.2.6	Verify that each automatic valve in the flow path is actuated to its correct position.	18 Months
SR 4.3.2.7	Verify that each pump develops at least [2500] gpm at a system head of [250] feet	18 Months
SR 4.3.2.8	Cycle each valve in the flow path that is not testable during plant operation through at least one complete cycle of full travel.	18 Months
SR 4.3.2.9	Verify that each fire suppression pump starts sequentially to maintain the Fire Suppression Water System pressure \geq [] psig.	18 Months
SR 4.3.2.10	Perform a flow test of the system in accordance with NFPA 25, Sections 3-3.1, 4-4.1.1, 5-3.3.1, 8-3.5, 94.3.2.2, 9-4.4.2.2.2, and Table 7-4, as applicable.	3 Years

Figure 11a. Example of Fire Suppression Water System Surveillance Requirements.

3/4.4 EMERGENCY POWER

3.4.1 STANDBY POWER DIESEL GENERATOR

LCO 3.4.1: The Standby Power Diesel Generator shall be OPERABLE.

MODE

APPLICABILITY: All MODES

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. The Standby Power Diesel Generator is inoperable.	A.1 Restore the Standby Power Diesel Generator to OPERABLE status.	8 Hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE REQUIREMENT		FREQUENCY
SR 4.4.1.1	Verify that the starting battery [parameters] for the Standby Power Diesel Generator are within [limits].	Monthly
SR 4.4.1.2	Perform a start and load test on the Standby Power Diesel Generator.	Monthly
SR 4.4.1.3	Verify that Standby Power Diesel Generator fuel oil storage tank is filled to greater than or equal to [7] day supply of fuel.	Within 24 Hours after each diesel engine shutdown
SR 4.4.1.4	Verify diesel fuel oil properties of new and stored fuel oil are tested in accordance with, and maintained within the limits of the Diesel Fuel Oil Testing Program.	In accordance with the Diesel Fuel Oil Testing Program

Figure 11b. Example of Diesel Generator LCO.

B3/4.4 EMERGENCY POWER	
B3.4.1 STANDBY POWER DIESEL GENERATOR	
BASES	
BACKGROUND SUMMARY	Backup power is automatically provided by a 300-kW diesel generator. Upon loss of normal power to either Motor Control Centers, MCC-A or MCC-B the transfer switch will automatically start the diesel generator and supply the ventilation exhaust fan. At a full-load fuel consumption the 550-gallon oil tank provides a service time of approximately 20 hours.
APPLICATION TO SAFETY ANALYSIS	This LCO is applied to ensure that backup power from the Standby Power Diesel Generator is available to support the operation of a ventilation exhaust fan following a loss of normal power. Operation of an exhaust fan is necessary to maintain the exhaust tunnel pressures required by LCO 3.3.1, which are required to protect the offsite public and to prevent and mitigate the consequences of an air reversal.
LIMITING CONDITION FOR OPERATION	The Standby Power Diesel Generator shall be OPERABLE to ensure that the ventilation exhaust system will be supplied with the necessary backup power during a loss of normal sources of electrical power. To be considered OPERABLE, the Standby Power Diesel Generator shall be supported by an OPERABLE starting battery (SR 4.4.1.1), an OPERABLE fuel supply (SRs 4.4.1.3 and 4.4.1.4), and have successfully undergone a periodic startup and load test (SR 4.4.1.2).
MODE APPLICABILITY	The Standby Power Diesel Generator is required to be OPERABLE during all MODES because radioactive materials are expected to be present within the Facility and the potential for a loss of normal power is credible.
ACTION STATEMENTS	<p>A.1</p> <p>If the Standby Power Diesel Generator is inoperable, Required Action A.1 requires the diesel generator to be restored to OPERABLE status within 8 Hours. The Completion Time of 8 Hours is based on the failure frequency of the loss of AC power to the Facility found in the DSA (Ref. 1).</p>

Figure 11b. Example of Diesel Generator LCO (continued)

B3/4.4 EMERGENCY POWER

B3.4.1 STANDBY POWER DIESEL GENERATOR

BASES (continued)

SURVEILLANCE
REQUIREMENTS

SR 4.4.1.1

The starting batteries on the Standby Power Diesel Generator shall be checked at least Monthly to ensure that the batteries are charged and capable of starting the generator on demand. Inspections shall include verification of proper voltage, proper cell electrolyte level and specific gravity of all cells (Ref. 1). The surveillance frequency is based on the low consequences associated with a loss of power and upon established practices.

SR 4.4.1.2

This SR demonstrates that the Standby Power Diesel Generator automatically starts from standby conditions and attains the required voltage and frequency within the specified time (15 seconds) in accordance with guidance provided in Reference 1. After achieving the required voltage and frequency, the diesel generator must supply at least 30% of the rated capacity for at least 30 minutes (Ref. 1). The surveillance frequency is based on the low consequences associated with a loss of power and upon established practices.

SR 4.4.1.3

The fuel oil level for the Standby Power Diesel Generator shall be checked within 24 Hours after each diesel engine shutdown to ensure that the fuel tank inventory is available to support [7] days of full load operation. The fuel oil inventory equivalent to a [7] day supply is [400] gallons and is based on a diesel consumption rate for the run time.

SR 4.4.1.4

The diesel fuel oil properties of new and stored fuel oil are tested in accordance with, and maintained within the limits of the Diesel Fuel Oil Testing Program. Testing shall include [specific gravity, appearance, particulates, etc. in accordance with national standards].

REFERENCES

1. Documented Safety Analysis – Facility.

Figure 11b. Diesel Generator LCO Example. (continued)

3/4.1 CRITICALITY PREVENTION

3.1.1 INVENTORY MATERIAL LIMIT IN PROCESS STREAM

LCO: The total FISSILE MATERIAL inventory in all gloveboxes and transport conveyors in the [facility] shall not exceed [] kg.

MODE APPLICABILITY: OPERATION, STANDBY, and PARTIAL SHUTDOWN

PROCESS AREA APPLICABILITY: [area 3]

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. The FISSILE MATERIAL inventory limit for a glovebox is exceeded.</p> <p><u>OR</u></p> <p>B. The FISSILE MATERIAL inventory limit for the facility gloveboxes and transport conveyors is exceeded.</p>	<p>----- NOTE ----- Action A.2 should involve the Criticality Safety Section. -----</p> <p>A.1 Enter STANDBY if in OPERATION, and stop all FISSILE MATERIAL transfers, handling, and sampling in the affected equipment.</p> <p><u>AND</u></p> <p>A.2 Develop and implement an approved plan to return the affected gloveboxes or transport conveyors inventory to within bounds of the specified limit.</p>	<p>IMMEDIATELY</p> <p>Before resuming OPERATION</p>

Figure 12. Example of Criticality Prevention TSR.

3/4.3 CRITICALITY PREVENTION**3.3.1 INVENTORY MATERIAL LIMIT IN PROCESS STREAM (continued)****ACTIONS (continued)****SURVEILLANCE REQUIREMENTS**

SURVEILLANCE REQUIREMENT		FREQUENCY
SR 4.3.1.1	Verify that the posted inventory in each glove box and transport conveyor is not exceeded.	Every shift
SR 4.3.1.2	Verify that the posted glovebox limit or transport conveyor limit will not be exceeded by beginning a new batch, transfer, or process operation in that equipment.	Before beginning a new batch, transfer, or process operation

Figure 12. Example of Criticality Prevention TSR (continued).

3/4.1 INSTRUMENTATION**3.1.7 CRITICALITY ALARMS**

LCO: Two Criticality Alarm Channels shall be OPERABLE for each monitored area listed below, with administratively controlled alarm set points set to actuate audible and visual alarms in the monitored area and the control room.

MODE APPLICABILITY: OPERATION, STANDBY, and PARTIAL SHUTDOWN

PROCESS AREA APPLICABILITY: [Product Receiving Area]
[Recovery Room]
[Process Room]
[Recovery Room Mezzanine]

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One Criticality Alarm Channel in any monitored area is inoperable.	A.1 Restore inoperable channel to OPERABLE status.	24 Hours
B. The ACTION and associated completion time of Condition A are not met.	B.1 Place the [] in PARTIAL SHUTDOWN.	1 Hour
	AND B.2 Restore inoperable channel to OPERABLE status.	4 Hours
C. Two Criticality Alarm Channels in any monitored area are inoperable.	C.1 Place the [] in PARTIAL SHUTDOWN.	1 Hour
	AND C.2 Restore at least one inoperable channel in OPERABLE status.	2 Hours
D. The ACTION(s) and associated completion times of Conditions B or C are not met.	D.1 Place the [] in FULL SHUTDOWN.	6 Hours

Figure 13. Example of Criticality Alarm TSR.

3/4.1 INSTRUMENTATION**3.1.7 CRITICALITY ALARMS (continued)****SURVEILLANCE REQUIREMENTS**

SURVEILLANCE REQUIREMENT		FREQUENCY
SR 4.1.7.1	Perform a CHANNEL CHECK.	Every shift
<p>----- NOTE ----- Test includes actuation of both visual and audible alarms in the control room and the monitored area. -----</p>		
SR 4.1.7.2	Perform a CHANNEL FUNCTIONAL TEST.	Semiannually
SR 4.1.7.3	Perform a CHANNEL CALIBRATION.	Annually

Figure 13. Example of Criticality Alarm TSR (continued).

3/4.1 CRITICALITY PREVENTION**3.1.1 EVAPORATION LEVEL AND SPECIFIC GRAVITY INSTRUMENTATION**

LCO: The evaporator LOW Level/Steam Flow Interlock shall be OPERABLE with a set point greater than or equal to XX.

AND

The evaporator High Specific Gravity/Steam Flow Interlock shall be OPERABLE with a set point less than or equal to YY._____.

MODE APPLICABILITY: OPERATION

PROCESS AREA APPLICABILITY: Evaporators that handle fissile material.

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
<ul style="list-style-type: none"> The Evaporator Low Level/Steam Flow Interlock is inoperable. The FISSILE MATERIAL inventory limit for a glovebox is exceeded. 	A.1 Stop the steam supply to the evaporator.	IMMEDIATELY
	<u>AND</u> A.2 Place the evaporator in STANDBY.	8 Hours
<ul style="list-style-type: none"> The Evaporator High Specific Gravity/Steam Flow Interlock is inoperable. 	B.1 Stop the steam supply to the evaporator.	IMMEDIATELY
	<u>AND</u> B.2 Place the evaporator in STANDBY.	8 Hours

Figure 14. Example of Criticality Prevention TSR.

3/4.1 CRITICALITY PREVENTION**3.1.1 EVAPORATOR LEVEL AND SPECIFIC GRAVITY INSTRUMENTATION (continued)****SURVEILLANCE REQUIREMENTS**

SURVEILLANCE REQUIREMENT		FREQUENCY
SR 3.3.1.1	Perform a FUNCTIONAL TEST on each evaporator Low Level/Steam Flow Interlock.	Semiannually
SR 3.3.1.2	Perform a FUNCTIONAL TEST on each evaporator High Specific Gravity/Steam Flow Interlock.	Semiannually
SR 3.3.1.1	Perform a CALIBRATION on each evaporator Low Level/Steam Flow Interlock.	Annually
SR 3.3.1.2	Perform a CALIBRATION on each evaporator High Specific Gravity/Steam Flow Interlock.	Annually

Figure 14. Example of Criticality Prevention TSR (continued).

3/4.2 CONFINEMENT SYSTEM**3.2.1 CONFINEMENT VENTILATION SYSTEM**

LCO: A. Two Confinement Ventilation Systems shall be OPERABLE with each system having the following components:

- One supply fan
- Two exhaust fans
- One supply-line charcoal filter
- One supply-line HEPA filter
- Two exhaust-line HEPA filters
- Exhaust flow instrumentation:
 - One exhaust flow indicator, with alarm
 - One beta-gamma radiation monitor, with alarm
 - One gas temperature sensor downstream of the filter

B. One Confinement Ventilation System shall be in operation.

MODE APPLICABILITY: OPERATION, STANDBY, and PARTIAL SHUTDOWN

PROCESS AREA APPLICABILITY: [process area(s)]

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One Confinement Ventilation System train is inoperable.	A.1 Restore Confinement Ventilation System train to OPERABLE status.	72 Hours
B. The ACTION and associated Completion Time of Condition A are not met.	B.1 Place the [process area(s)] in FULL SHUTDOWN.	6 Hours
C. Both Confinement Ventilation Systems trains are inoperable	C.1 Place the [process area(s)] in PARTIAL SHUTDOWN.	1 Hour
	AND C.2 Restore one system to OPERABLE status.	2 Hours

Figure 15. Example of Confinement Ventilation System LCO.

3/4.2 CONFINEMENT SYSTEM**3.2.1 CONFINEMENT VENTILATION SYSTEM****SURVEILLANCE REQUIREMENTS***Sheet 1 of 2*

SURVEILLANCE REQUIREMENT		FREQUENCY
SR 4.2.1.1	Verify that each Confinement Ventilation System train in operation is taking suction on the confinement zone at a rate of [] scfm or more.	8 Hours
SR 4.2.1.2	Verify that the Confinement Ventilation System train in standby is aligned to take suction on the confinement zone and that the fan control is in “AUTO” position.	8 Hours
SR 4.2.1.3	Operate each Confinement Ventilation System train for ≥ 10 hours continuous with the heaters operating or (for systems without heaters) ≥ 15 minutes].	Monthly
SR 4.2.1.4	Perform the following on each confinement exhaust flow indicator and alarm. <ul style="list-style-type: none"> • CHANNEL CHECK • CHANNEL FUNCTIONAL TEST • CHANNEL CALIBRATION 	Daily Quarterly Annually
SR 4.2.1.5	Perform the following on each exhaust flow beta-gamma radiation monitor and alarm. <ul style="list-style-type: none"> • CHANNEL CHECK • CHANNEL FUNCTIONAL TEST • CHANNEL CALIBRATION 	Daily Quarterly Annually
SR 4.2.1.6	Perform the following on each exhaust flow gas temperature sensor. <ul style="list-style-type: none"> • CHANNEL CHECK • CHANNEL FUNCTIONAL TEST • CHANNEL CALIBRATION 	Daily Quarterly Annually

Figure 16. Example of Confinement Ventilation System Surveillance Requirements.

3/4.2 CONFINEMENT SYSTEM**3.2.1 CONFINEMENT VENTILATION SYSTEM (continued)****SURVEILLANCE REQUIREMENTS (continued)***Sheet 2 of 2*

SURVEILLANCE REQUIREMENT	FREQUENCY
SR 4.2.1.7 For each Confinement Ventilation System train, verify that the filter cleanup system satisfies the in-place penetration and bypass leakage testing acceptance criteria of < [*]% and uses test procedure guidance in Regulatory Positions C.5.a, C.5.c, and C.5.d of Regulatory Guide 1.52, Revision 2, March 1978, and verify that the system flow rate is [] cfm \pm 10%.	18 Months <u>OR</u> After any structural maintenance on the HEPA filter or charcoal absorber housings <u>OR</u> Following painting, fire, or chemical release in any ventilation zone communicating with the system

Figure 16. Example of Confinement Ventilation System Surveillance Requirements (continued).

B3/4.5.10 PRESSURIZER SAFETY VALVES**B3/4.5 PRESSURE LIMITS****BASES:**

LCOs: LCOs 3/4.5.1 through 3/4.5.9 establish the general requirements for pressure control.

LCO 3/4.5.1

- a. Background
- b. Applicable Safety Analysis

LCO 3/4.5.1 establishes the limiting conditions for operation for the Pressurizer Safety Valves (PSV) based on the relief capacity requirements identified in Section 11.x.yy of the DSA. The single failure criterion requires that 2 PSVs be **OPERABLE** for operation and start-up modes.

- c. Safety and Operating Limits
- d. ACTION Statements
- e. Surveillance Requirements
- f. References

LCO 3/4.5.2 establishes the limiting condition for.

Figure 17. Example of Bases Appendix.

GENERAL LIMITING CONDITIONS FOR OPERATION (LCOS) 3.0.X

LCO 3.0.1 LCOs shall be met during the MODES or other specified conditions in the Applicability, except as provided in LCO 3.0.2.

LCO 3.0.2 Upon discovery of a failure to meet an LCO, the associated ACTIONS shall be met, except as provided in LCO 3.0.5 and LCO 3.0.6. If the LCO is restored or is no longer applicable before the specified completion time(s) expires, completion of the ACTION is not required, unless otherwise stated.

The Completion Time(s) for Required Action(s) are also applicable when a system or component is intentionally removed from service. Acceptable reasons for intentionally entering Required Action(s) for an LCO include, but are not limited to, performance of SRs, preventive maintenance, corrective maintenance, or investigation of operational problems.

LCO 3.0.3 When an LCO statement is not met and the associated ACTIONS are not met, or when an associated ACTION is not provided, the facility shall be placed in a MODE or other specified condition in which the LCO is not applicable. If the LCO is applicable in all MODES, the facility shall be placed in the safest MODE. Activities shall be initiated to place the affected PROCESS AREA(S) or facility in STANDBY within 1 hour. The affected PROCESS AREA or facility shall be in STANDBY within 12 hours.

Where corrective measures are completed that permit operation in accordance with the LCO or ACTIONS, completion of the ACTIONS required by LCO 3.0.3 are not required.

LCO 3.0.3 is applicable in all MODES. Exceptions to LCO 3.0.3 may be stated in the individual LCOs.

LCO 3.0.4 When an LCO is not met, a MODE or other specified condition in the Applicability shall not be entered, except when the associated ACTIONS to be entered permit continued operation in the MODE or other specified condition in the Applicability for an unlimited period of time. LCO 3.0.4 shall not prevent changes in MODES or other specified conditions in the Applicability that are required to comply with ACTIONS or that are part of a shutdown of the affected PROCESS AREA(S) or facility.

Exceptions to LCO 3.0.4 are stated in the individual LCOs. When an individual LCO states that LCO 3.0.4 does not apply, it allows entry into MODES or other specified conditions in the Applicability when the associated ACTIONS to be entered permit operation in the MODE or other specified condition for only a limited time.

LCO 3.0.5 Equipment removed from service or declared inoperable to comply with ACTIONS may be returned to service under administrative control solely to perform testing required to demonstrate its OPERABILITY or the OPERABILITY of other equipment. This is an exception to LCO 3.0.2 for the system returned to service under administrative control to perform the testing required to demonstrate OPERABILITY.

LCO 3.0.6 When a support system is declared inoperable, the supported systems are also required to be declared inoperable. However, only the support system's ACTIONS are required to be entered, provided they reflect the supported system's degraded safety condition. This is a clarification of the definition of OPERABILITY. This is an exception to LCO 3.0.2 for the supported system.

Figure 18a. Example of General LCO

SURVEILLANCE REQUIREMENTS

- SR 4.0.1** **SURVEILLANCE REQUIREMENTS** shall be met during the Operational Modes or other conditions specified for individual LCS and LCOs unless otherwise stated in an individual **SURVEILLANCE REQUIREMENT**. Failure to meet a Surveillance, whether such failure is experienced during the performance of the Surveillance or between performances of the Surveillance, shall be failure to meet the LCO, except as provided in SR 4.0.3. Surveillances do not have to be performed on inoperable equipment or variables outside specified limits.
- SR 4.0.2** Each **SURVEILLANCE REQUIREMENT** shall be performed within the specified frequency. The specified frequency for each SR is met if the Surveillance is performed within 1.25 times the interval specified in the frequency, as measured from the previous performance or as measured from the time a specified condition of the frequency is met.
- For frequencies specified as “once,” the above interval extension does not apply.
- If a Completion Time requires periodic performance on a “once per . . .” basis, the above frequency extension applies to each performance after the initial performance.
- Exceptions to this Specification are stated in the individual Specifications.
- SR 4.0.3** Failure to perform a **SURVEILLANCE REQUIREMENT** within 1.25 times the specified time interval (TSR violation) shall constitute a failure to meet the **OPERABILITY** requirements for a **LIMITING CONDITION FOR OPERATION**. The **LCO ACTIONS** shall be entered at the time it is determined that the SR has not been performed or is not met, except as provided below.
- If it is discovered that a Surveillance was not performed within its specified Frequency, then compliance with the requirement to declare the LCO not met may be delayed, from the time of discovery, up to 24 hours or up to the limit of the specified Frequency, whichever is less. This delay period is permitted to allow performance of the Surveillance.
- If the Surveillance is not performed within the delay period, the LCO must immediately be declared not met, and the applicable Condition(s) must be entered.
- When the Surveillance is performed within the delay period and the Surveillance is not met, the LCO must immediately be declared not met, and the applicable Condition(s) must be entered.
- SR 4.0.4** Entry into an Operational Mode or other specified condition shall not be made unless the **SURVEILLANCE REQUIREMENT(S)** associated with the **LIMITING CONDITION FOR OPERATION** has been performed within the stated surveillance interval or as other otherwise specified. When an LCO is not met due to Surveillances not having been met, entry into a **MODE** or other specified condition in the Applicability shall only be made in accordance with LCO 3.0.4.

Figure 18b. Example of General SR

5.0	ADMINISTRATIVE CONTROLS
5.1	Responsibility
	[NOTE: Titles for members of the Facility staff shall be based on the Facility organizational structure.]
5.1.1	The Facility Manager shall be responsible for overall safe operation of the FACILITY and shall have control over those activities necessary for safe operation of the FACILITY. The Facility Manager shall delegate, in writing, the succession to this responsibility during any absences.
5.1.2	The Control Room Supervisor (CRS), or in their absence a designated, qualified individual, shall be responsible for the FACILITY command function. As part of this command function, the CRS shall ensure operation of the FACILITY is in accordance with approved TSRs.
5.2	Organization
5.2.1	Organization <ul style="list-style-type: none"> a. Lines of authority, responsibility, and communication shall be defined and established for the highest management levels, through intermediate levels, down to and including all operating organization positions. b. The individuals who train the operating staff, carry out radiological control, or perform Quality Assurance (QA) functions may report to the Facility Manager; however, they shall have sufficient organizational freedom to ensure their independence from operating pressures.
5.2.2	FACILITY Staff <p>The FACILITY staff organization shall be as follows:</p> <ul style="list-style-type: none"> a. A current list of FACILITY support personnel shall be maintained. This list should include management, radiation safety, and technical support personnel. b. The minimum FACILITY shift crew composition shall be as shown in Table 5.2.2-1. c. Administrative procedures shall be developed and implemented to limit the working hours of staff who perform safety-related functions (e.g., personnel required to meet the minimum shift crew composition).

Figure 19. Example of Administrative Controls.

5.2Organization (continued)

5.2.2FACILITY Staff (continued)

Table 5.2.2-1 {FACILITY} Minimum Shift Crew Composition¹

MODE	CRS	CRO	BOP	RC
OPERATION	1	3	3	1
STANDBY	1	2	3	1
MAINTENANCE	1	2	3	1

CRS

Control Room Supervisor

CRO

Control Room Operator

BOP

Balance of Plant Operator/Supervisor

RC

Radiological Control

¹ During a shift, to accommodate unexpected absences of on-duty shift crew members, the shift crew composition may be one less than the minimum requirements for not more than 2 Hours provided immediate action is taken to restore the shift crew composition to within the minimum requirements. This provision is not applicable at the time of shift turnover.

5.3Staff Qualifications and Training

5.3.1Qualification

A program shall be established to ensure that FACILITY staff who perform safety-related functions meet established qualification requirements for their positions. This program shall adhere to qualification requirements established in accordance with applicable DOE regulations.

5.3.2Training

An initial training and retraining program for the FACILITY staff shall be established and maintained. This program shall adhere to training requirements established in accordance with applicable DOE regulations.

Figure 19. Example of Administrative Controls (continued).

5.7	Procedures, Programs, and Manuals
5.7.2	Programs and Manuals
The following programs shall be established, implemented, and maintained.	
5.7.2.1	<p>Radiation Protection Program</p> <p>The radiation protection program shall ensure that the radiation exposure of onsite and offsite individuals is maintained within applicable DOE limits and is As Low As Reasonably Achievable (ALARA). The program shall ensure that individual and collective radiation exposures are minimized. Procedures for personnel radiological protection shall be prepared consistent with DOE requirements and shall be approved, maintained, and adhered to for all operations involving personnel radiation exposure.</p>
5.7.2.2	<p>FACILITY Fire Protection Program</p> <ol style="list-style-type: none"> 1. A FACILITY fire protection program shall be established to minimize the following: <ol style="list-style-type: none"> a. Threats to the public health or welfare resulting from a fire b. Undue hazards to site personnel from a fire 2. The fire protection program shall include the following: <ol style="list-style-type: none"> a. Fire Prevention <ol style="list-style-type: none"> 1) Fire-resistive construction 2) Control of combustibles 3) Control of ignition sources 4) FACILITY inspections 5) Handling of combustible or flammable liquids and gases 6) Fire Protection impairment control and compensatory action process b. Fire Control <ol style="list-style-type: none"> 1) Automatic detection/suppression and alarm systems 2) Fire Watches/Patrols (as necessary) 3) Proper availability and maintenance of FACILITY firefighting equipment 4) Identification of firefighting personnel, responsibilities, and training 5) Fire barriers (as required by the DSA) 6) 24-hour firefighting coverage

Figure 19. Example of Administrative Controls (continued).

5.7	Procedures, Programs, and Manuals (continued)
5.7.2.5	Configuration Management Program
<p>A Configuration Management Program shall be established, implemented, and maintained that:</p> <ul style="list-style-type: none">a. Identifies and documents the technical baseline of Structures, Systems, Components and computer software;b. Ensures that changes to the technical baseline are properly developed, assessed, approved, issued, and implemented;c. Maintains a system for recording, controlling, and indicating the status of technical baseline documentation on a current basis; andd. Controls the configuration of the SSCs specified in the Design Features section of this TSR.	

Figure 19. Example of Administrative Controls (continued).

Appendix C: Independent Implementation Verification Reviews (IVRs)

1. PURPOSE

This appendix describes approaches for performing independent implementation verification reviews of all controls designed to implement the Safety Basis. Such controls include TSRs, Safety Evaluation Report (SER) requirements and DSA assumptions and commitments.

The purpose of an IVR is to independently confirm the proper implementation of new or revised safety basis controls. Independence of the review adds an additional layer of defense in depth and is a common practice standard in the commercial nuclear power industry. IVRs support meeting the 10 CFR §830.201 requirement for operating contractors for Hazard Category 1, 2, or 3 nuclear facilities to “perform work in accordance with the facility safety basis” and quality assurance (QA) requirements found in 10 CFR Part 830, Subpart A. Special emphasis is placed on 10 CFR §830.122(j), Criterion 10, which mandates “independent assessments to measure item and service quality, to measure the adequacy of work performance, and to promote improvement.”

2. APPLICABILITY AND SCOPE OF APPENDIX

This appendix is intended for use by DOE and DOE contractor organizations responsible for Hazard Category 1, 2 and 3 nuclear facilities. It applies to all hazard controls identified in TSRs, SER, and in DSA assumptions and commitments for such facilities. This appendix is focused on IVRs performed by operating contractors but also provides guidance for DOE’s oversight of IVRs. The scope of this appendix includes initial verification of safety basis controls for new DSAs and DSA revisions (both major and minor) as well as periodic review of the continued effective implementation of safety basis controls.

The appendix is limited to independent verification of the implementation of safety basis hazard controls. It does not address the review of the safety basis documentation itself. Guidance for review of such documentation can be found in DOE Guide 421.1-2, *Implementation Guide for Use in Developing Documented Safety Analyses to Meet Subpart B of 10 CFR 830*.

3. WHEN TO CONDUCT AN IVR

3.1. Initial IVRs

The initial contractor IVR should follow the initial implementation of the new safety basis. The IVR should be completed prior to the contractor declaring readiness to commence operation under the new controls. The IVR may be a prerequisite to a Readiness Review required in accordance with DOE Order 425.1D, *Verification of Readiness to Startup or Restart Nuclear Facilities*. The IVR should not be part of, or a substitute for any part of, a required Readiness Review.

Prior to commencing the IVR, contractor line management should ensure that the safety basis has been fully implemented. This means that safety basis controls are implemented to the point

that independent verification of their efficacy is practical. The following are attributes of a fully implemented safety basis:

- All requirements, assumptions, and commitments in the TSRs and DSA have been identified and implementing controls have been developed.
- Safety basis controls have been incorporated into implementing procedures and work control documents.
- Implementing procedures are executable as written.
- Document configuration control procedures are fully developed and implemented such that any changes to implementing procedures will receive an appropriate USQ review.
- A DOE-approved Unreviewed Safety Question procedure has been implemented.
- Operators and facility personnel are trained and knowledgeable on the new controls and their relationship to the safety basis.
- Required surveillance activities and inspections are complete.
- Surveillances correctly test or verify assumptions and requirements of the safety basis.
- Physical changes associated with the safety basis change have been made and tested under a rigorous startup test process to verify operability in accordance with the design basis.
- Configuration items have been updated to reflect safety basis changes, (e.g. drawings, design documents, software).
- Labeling of components identified in updated safety systems has been completed.
- Inventory control procedures have been evaluated for consistency with the new safety basis.
- Process instruments, tools, and measuring and test equipment have been calibrated and tested.

Contractors often create and utilize a flow down matrix to support proper implementation of safety basis controls. An example of such a matrix appears below:

TSR Requirement	Implementing Procedure or Policy
5.7.1 Restricted Public Access to Transfer Route SAC: Public vehicular access to the transfer route SHALL be restricted.	P&T-WI-003, Trip Commander Instructions
5.7.2 Combustible Material Limits SAC: The transfer vehicle cargo storage area SHALL be inspected and combustible materials that do not support normal ongoing transfer operations SHALL be removed prior to transfer.	P&T-WI-002, Driver Instructions

3.2 IVRs Following Safety Basis Changes

Following a safety basis change, an IVR should be performed and any pre-implementation findings closed prior to commencing operation under the revised safety basis

The breadth of the IVR should encompass the entire safety basis change, which means that all safety basis controls that have been created or changed should be verified as fully implemented. However, the depth and level of detail and the degree of formality of the review can be graded as follows:

- “Major” Changes – Multiple changes, physical alterations of credited components, or changes in methods used to demonstrate operability of TSR hazard controls. Major changes are those that could potentially affect the ability to comply with the safety basis.
- “Moderate” Changes – safety basis changes that may warrant review prior to use. Moderate changes are more complex than editorial changes and may involve changes in multiple acceptance criteria for safety class or safety significant items.
- “Minor” Changes – Editorial changes. If there is no impact on TSR controls, an IVR is not required.

For major changes, the IVR should utilize formal tools such as a review plan and a criteria and review approach document (CRAD) (see Form 1 below for an example of a CRAD). For moderate changes, review plans and CRADs may not be needed—a simple checklist may suffice—or they may be graded in the depth of the review. For minor changes, an IVR plan is likely not needed; a simple checklist (see Form 3 below) may suffice.

The scope of DOE oversight of the IVR, if performed, can be determined based upon these same factors as well as considering past performance/effectiveness of contractor IVRs.

3.3 IVRs to Re-verify Control Implementation

The reverification of safety basis controls is an important tool for contractors to ensure that they remain in compliance with the safety basis. Contractors should develop and maintain a schedule of periodic IVR reverification activities as part of their ongoing assessment process. In general, reverification of safety basis controls should be performed every three to five years as part of the contractor's ongoing assessment process. Safety basis controls that are susceptible to the effects of the degradation of human knowledge (e.g., procedural controls) typically should be re-verified at least every 3 years, and controls dependent upon hardware functionality typically should be re-verified at least every 5 years.

The following factors should be considered in determining the specific frequency, scope, and depth of reverification of a safety basis control:

- Safety significance of the control,
- Type of control and susceptibility to deterioration, and
- Extent of control changes that have accumulated since the last IVR

The basis for the periodicity of IVRs should be described and documented in individual site implementing procedures.

The overall effectiveness of safety management programs referenced in TSRs (such as criticality safety and conduct of operations) is normally ensured by specific assessments already required for each of those programs.

Reverification of a facility's safety basis controls can be planned in a number of different, equally acceptable ways. A single review might be conducted by a relatively large team that re-verifies all the facility's controls in one review. Another option would be phased reviews, with a fraction of the controls being reviewed each year. However, if periodic SMP program assessments are not conducted, or if adverse trends in program performance are observed, the IVR reverification process can be used to examine these controls as well.

The benefit of the periodic, full-scope team review is that it ensures all safety basis controls will be reviewed in an integrated fashion. The disadvantage of this approach is cost in terms of human resources and dollars. A phased approach, depending on how it is structured, might not be as effective in identifying cross-cutting issues, but it can be more easily integrated into the facility's existing assessments and hence may be more cost effective. An example of a phased approach is provided below:

Facility: Typical Nuclear Facility		
TSR Control	Description	FY
AC 5.6.8	Hazardous Material Program	13
AC 7.7.3	Hot Inlet System Controls	13
LCO/SR 3/4.6	WETF Combustible Loading	14
LCO/SR 3/4.8	Halon Suppression System	14
LCO/SR 3/4.5	Uninterruptable Power Supply	14
LCO/SR 3/4.4	Tritium Monitoring System	14
LCO/SR 3/4.9	Tritium Gas Handling System	14
LCO/SR 3/4.2	Wet Pipe Sprinkler System	14

Facility: Typical Nuclear Facility		
TSR Control	Description	FY
DF 6.2.2	Tritium Containment Vessels	14

DOE may also perform periodic reverification of safety basis controls. DOE's review can be performed as part of normal oversight and may not be as formal or detailed as the contractor's reverification assessment. What approach DOE takes should be determined as part of the integrated oversight planning.

4. IVR PLANNING AND PERFORMANCE

As discussed previously, for major, or in some cases moderate, changes in the safety basis, a formal IVR plan should be developed. A formal IVR plan is also useful for performing reverification of safety basis controls. The IVR plan should cover (a) scope of the review, (b) staff to be made available, (c) methods to be employed, and (d) schedule. The IVR for a new or major modification of a safety basis should include all applicable attributes listed in Section 3.1 above.

IVR plans should be approved by responsible line manager designated in the site's implementing procedures for the IVR process. Form 1 provides an example outline of an IVR plan.

The contractor IVR plan should be consistent with normal site practices for developing review plans and should be an element of an overall contractor assurance system. If a phased approach is utilized for performing reverification, a plan that covers the complete reverification and which specifies items to be reviewed, the method of review, and schedule for each phase of the review should be developed.

Forms 2, 3, 4, and 5 are examples of the types of CRADS, Lines of Inquiry, or checklists that may be applicable for the particular IVR. The level of detail and the specificity of the enclosures will depend on the complexity of the IVR, whether it is a reverification or a new safety basis and to some extent depend on the experience and independence of the IVR team. In most situations, the review plan forms will determine the adequacy and accuracy of the IVR. The team leader must provide technical expertise and leadership to ensure the review plan is adequately comprehensive and explicit to achieve the necessary results of the IVR.

4.1 Selection of an IVR Team Leader and Support Staff

The IVR team leader (or individual assessors) should have sufficient authority and freedom from line management responsible for the safety basis controls to be evaluated. Assessors should not have been involved in writing or implementing the controls to be verified.

IVR support staff should be experienced in the technical area being reviewed. The size and makeup of the contractor team will depend upon the scope, and depth, and level of detail of the review. Members should not review work in which they were involved

The IVR team makeup should be determined based on a graded approach that considers the scope and complexity of the safety basis changes. Good candidates for the IVR team include: personnel with team leader experience and operational readiness review experience, System Engineers, senior operations and maintenance personnel from other similar facilities, and other subject matter experts.

Not all IVRs will require the formation of teams. An IVR focused on a single technical area can be performed by a qualified individual not involved previously in the controls to be assessed.

4.2 Methods for Performing IVRs

4.2.1 Review of Design Features and Safety Systems

Implementation verification of design features and safety systems should include a review of documentation and a walkdown. The walkdown is intended to verify that certain design features and safety systems are in place and installed in accordance with approved design drawings. For safety-class and safety-significant items, the review should verify that procurement, construction and testing were guided by an appropriate level of quality assurance. Particular attention should be paid to any installed “temporary modification.” Implementation verification of safety systems may also include a review of startup testing. The extent of the review should be predicated on the complexity and importance of the design feature or safety system. In the case of a reverification which includes physical changes, The IVR team should verify that the changes were designed and implemented in accordance with procedures and policies.

4.2.2 Review of Procedures

Maintenance, Inspection and Testing, and Surveillance Procedures. These procedures should be reviewed to ensure: (a) that they include limits, precautions, prerequisite conditions, applicable TSRs, acceptance criteria, required data to be recorded, and personnel qualifications, and (b) to determine whether they require the recording and timely notification of facility management of any discrepancies or unexpected conditions. (Typically sites will utilize a checklist to support their review of TSR surveillances.) The review of surveillances should include an evaluation of the mechanism (such as a schedule) used to ensure they are conducted when required, and whether they are consistently being performed on time. An example of a TSR surveillance checklist is provided in Form 4.

Depending upon the level of depth of review, the IVR of a procedure can include (a) a walkdown of the procedure accompanied by responsible facility personnel, (b) observation of the procedure being performed, or (c) a review of procedure execution records. During a verification following physical changes, The IVR team should verify that the change was flowed into implementing documents (e.g., procedures). Drawings and configuration control documentation should be reviewed for accuracy and completion.

Specific Administrative Controls. The IVR should include review of written implementing procedures and either observation of execution of the procedure or a walkdown with contractor personnel responsible for executing the procedures. Form 5 provides some additional criteria to support this verification.

4.2.3 Training Programs and Personnel Level of Knowledge

Operators, maintenance personnel, technicians and engineers that implement and maintain safety basis controls need to be properly trained and qualified. The IVR should evaluate the training of these individuals on (a) the need for and functions of the controls, (b) ability to verify that the controls are reliable, and (c) knowledge of how to perform any required safety functions in relation to those controls. The level of knowledge can be assessed using direct questioning and hypothetical cases.

Finally, the IVR should include a review of documentation showing that a systematic approach to training has been used in accordance with DOE O 426.2, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities*.

4.3 Documentation of Results

The results of the IVR should be documented in accordance with normal site procedures for documentation of safety-related assessments and, identification of issues requiring corrective actions.

The forms provided below are examples for planning, conduct and documenting the results of the IVR. They can be shortened or expanded as necessary. To ensure consistency of IVRs, documentation forms should be included in site-specific implementing procedures.

Form 1**Independent Implementation Verification Review Plan**

The following is a template for Independent Implementation Verification Review (IVR) Plans employing Criteria Review and Approach Documents (CRADs) and Lines of Inquiry (LOIs). This level of detail is appropriate for an initial safety basis implementation or major safety basis change. The site implementing procedures for the IVR process should include procedures for designation of the team leader, assignment of team members, approval of the review plan, and management of the final report.

INTRODUCTION/BACKGROUND

Provides background information concerning the new or modified safety basis document, new hazards, and issues associated with the safety basis implementation to be reviewed.

SCOPE OF THE REVIEW

Identifies the safety basis controls whose implementation will be verified including the breadth and depth of the review.

- Facility/Systems/Equipment/Components
- Personnel
- Implementing Procedures

IVR PREPARATIONS

Identifies individuals or team members and describes any preparations, including pre-review activities, document reviews, and development of CRADs that will be undertaken prior to the formal start of the IVR. A discussion of training considerations for reviewers should appear here.

- Review Team Selection and Assignments
- Review Team Preparations
- Review Team Training

IVR REVIEW PROCESS

Describes the review approach including use of checklists or a Criteria Review and Approach Document (CRAD), team meetings, and daily reporting expectations.

Describes the mechanism for the IVR-related meetings, correspondence, communications, team structure, etc., of the review. The team composition/organization, interface requirements, any oversight groups, and DOE organizations to be involved in the review should be discussed in this section.

REPORTING AND RESOLUTIONS

Details the methods that the team will use to report IVR results. These elements include documentation of the results, including good practices, findings, and observations, lessons learned from the review, and the final report.

SCHEDULE

A discussion of the proposed schedule for conduct of the review, report preparation, and closeout.

APPROVALS

Plan development should be monitored by the IVR Team Leader. The plan should be approved as specified in the site's procedures.

APPENDICES

Include reporting forms, CRADs, Lines of Inquiry (LOI), Lessons Learned from previous IVRs, resumes or summary of team members' relevant experience, and other sections appropriate to stand alone in an appendix.

Form 2**Example: Criteria Review and Approach Document (CRAD) to Support IVRs**

The following are example CRADs. The CRADs used for IVRs need to be tailored to the safety basis controls being verified. Some review approaches will be based on document review, while others will be performed by interviews or physical inspections.

Objective 1: *Verify that the safety basis controls and requirements are incorporated in appropriate facility documents and work instructions.*

Criteria:**1.1 Administrative Controls, implementing processes, and supporting surveillance requirements are adequately documented in reviewed and approved work instructions.****Review Approach**

- Are controlled, accurate, and current copies of the TSR available where needed?
- Are there adequate and correct work instructions for implementing the Surveillance Requirements associated with Administrative Controls? Are accurate data sheets provided?
- Describe the documented work processes used to control waste crate and container handling within the building. What control prevents the storage of waste drums and crates outside the facility? Does the safety basis allow storage of low-level waste (LLW) crates outside the facility and what process is used to manage the configuration and locations of LLW crates stored outside the building?
- How are limits established, implemented, and maintained for required sizing and spacing between each combustible package and other items of concern?
- Approval has been given to store combustibles for up to 15 minutes in specific corridors without meeting spacing requirements. What process controls this condition and how is the time material is stored recorded? What control prevents exceeding the allowed time?
- How is the storage of combustibles controlled to ensure that they are not stored in prohibited areas of the facility? What control or barrier exists that prevents the introduction of combustible material into the facility? Has a “Combustion-Free” zone been established in the facility?
- What barrier or control ensures that combustible loading in a glovebox does not exceed applicable limits?

1.2 Limiting Conditions for Operations (LCOs) and supporting Surveillance Requirements and acceptance criteria are adequately documented in reviewed and approved work instructions that are consistent with the facility safety basis and applicable Safety Evaluation Reports (SERs).

Review Approach

- Are adequate and correct work instructions implementing the Surveillance Requirements prepared, reviewed, and approved? How is the configuration of these documents controlled and maintained?
- Do work instructions for Surveillance Requirements describe the limitations beyond which an Out-of-Tolerance condition would exist? How are limitations defined for Planned Out-of-Tolerances?
- Are the acceptance criteria for Surveillance Requirements documented in appropriate work instructions? Are they consistent with the corresponding Safety Evaluation Report? How has consistency been verified?
- Are Violations, Out-of-Tolerance Conditions, Emergency Evacuations, and Return to Service situations covered by adequate work instructions?
- Are safety system instruments and other measuring devices that monitor TSRs monitored for calibration? What controls are established to ensure proper calibration is maintained for TSR-related measuring devices?
- Have safety basis controls been established for the movement and control of Material-at-Risk (MAR)? How have these controls been incorporated in MAR-related work instructions? How will material holdup in the facility be handled during deactivation and decommissioning as it relates to MAR? How often is the building MAR reconciled?

Objective 2: *Verify that facility personnel are knowledgeable of safety basis controls and requirements.*

Criteria:

2.1 Training and Qualification programs for facility and building managers, operations support, and operations personnel have been established, documented, and implemented. The programs cover the range of duties required as a result of the facility safety basis implementation.

Review Approach

- Are USQ evaluators trained and qualified on the new safety basis? If USQ screens were used in the determination of procedures needing changes for the new safety basis, what

process and what requirements were the evaluators trained on? Is the training documented?

- Is a documented training program in place that establishes safety basis-related training requirements for personnel assigned to the facility or working in the buildings? What controls are implemented to ensure that only trained workers are permitted to conduct activities in the facility? Are training records current and used? Do training records reflect safety basis-related training? Do they reflect requirements for USQ evaluators? Is there a continuing training program that treats safety basis-related aspects?
- How are support services personnel screened for required safety basis-related training? How are subcontractors' employees working in the facility trained in safety basis and other activity requirements? How do you ensure that new personnel receive the appropriate training prior to work in the facility?
- What requirements apply to the training provided to personnel assigned to stand fire watches?
- Are facility, support organization, and subcontractor personnel aware of safety basis-related facility functions, assignments, responsibilities, and reporting relationships?
- Does documented evidence exist to confirm that facility response personnel are current in their training?

2.2 Level of knowledge of the safety basis controls and of proper response to credible scenarios is adequate.

Review Approach

- Do interviews of operations personnel indicate proper understanding of the purpose and use of the safety basis controls?
- Do table-top exercises of credible scenarios involving use of the safety basis controls indicate adequate knowledge of proper response to the scenarios?

2.3 Training has been performed and documented to the latest revision of the facility safety basis and its implementing work instructions.

Objective 3: *Verify that safety basis controls and requirements have been implemented.*

Criteria:

3.1 Administrative Controls and associated surveillance requirements established through the safety basis are implemented or can be implemented in applicable facilities and programs.

Review Approach

- Is there adequate documented evidence that periodic inspections have been conducted to detect degraded drums, cans, and bottles containing radioactive material?
- Does a walkdown of the facility demonstrate that containers requiring venting are identified and any required venting and purging are performed?
- Does documented evidence demonstrate that the facility tracks chemicals and hazardous waste substances? Is a current inventory available? How is it maintained current? Are quantities below regulatory thresholds? Are changes to the inventory compared to the inventory relied on in the safety basis?
- Does a walkdown of the facility indicate that the chemical management program is adequately implemented?
- Does documented evidence demonstrate that surveillance requirements are being met?

3.2 There are sufficient numbers of qualified personnel to support the safe implementation of the controls established through the safety basis.**Review Approach**

- How has minimum staffing been established to ensure sufficient support for the implementation of safety basis controls? How is it determined that staffing is not sufficient? What actions would be taken in this case?
- Are the training functions sufficiently staffed to ensure safety basis-related training is maintained current?

3.3 LCOs and associated Surveillance Requirements established through the safety basis are implemented or can be implemented in applicable complex facility programs.**Review Approach**

- Does documented evidence demonstrate the scheduling and tracking of LCO- and AC-related SRs? How have grace periods been applied? Is documented and objective evidence available to demonstrate the scheduling and tracking of AC-related Surveillance Requirements? How are grace periods applied to AC-related surveillance requirements? Can grace periods be compounded?
- During the observation of the surveillance process, does the operator take appropriate actions to follow Conduct of Operations?

- Does documented evidence demonstrate that the facility has established an adequate baseline of the results of LCO and AC Surveillance Requirements?

Objective 4: *Verify that safety systems and/or design features are consistent with the safety basis.*

Criteria:

4.1 Safety systems and/or design features are installed that are consistent with the descriptions and functions provided in the safety basis.

Review Approach: Does a walkdown of the safety systems and/or design features indicate that the installed systems are consistent with the descriptions and functions provided in the safety basis?

Form 3

Independent Implementation Verification Review (IVR) Checklist

Section 1 - Checklist IVR Facility and Safety Basis (SB) Change Information

IVR# : _____ Facility: _____ DSA/TSR Revision _____

Safety Basis (SB) Change Description:

Date of Performance _____ / _____ / _____

Section 2 - SB Documentation Verification

Instructions: Review affected SB documents to ensure that SB controls are adequately translated into governing facility documents and that SB controls have been, or can be, effectively implemented.

Note: Significant issues identified during checklist performance that could affect compliance with the SB, current or future, are to be immediately brought to the line management attention

SB Change Document Category	SB Controls Adequately Implemented/Documented?	
	Fully Implemented	Independent Reviewer
Technical Safety Requirements (TSRs)	<input type="checkbox"/> Yes <input type="checkbox"/> No _____ / _____ <input type="checkbox"/> N/A Intl Date	<input type="checkbox"/> Yes <input type="checkbox"/> No _____ / _____ <input type="checkbox"/> N/A Intl Date
Conditions of Approval (COAs)	<input type="checkbox"/> Yes <input type="checkbox"/> No _____ / _____ <input type="checkbox"/> N/A Intl Date	<input type="checkbox"/> Yes <input type="checkbox"/> No _____ / _____ <input type="checkbox"/> N/A Intl Date
USQ program is updated; checklists are updated; USQD evaluators have been trained	<input type="checkbox"/> Yes <input type="checkbox"/> No _____ / _____ <input type="checkbox"/> N/A Intl Date	<input type="checkbox"/> Yes <input type="checkbox"/> No _____ / _____ <input type="checkbox"/> N/A Intl Date
Operations Orders	<input type="checkbox"/> Yes <input type="checkbox"/> No _____ / _____ <input type="checkbox"/> N/A Intl Date	<input type="checkbox"/> Yes <input type="checkbox"/> No _____ / _____ <input type="checkbox"/> N/A Intl Date
Implementing Documents	<input type="checkbox"/> Yes <input type="checkbox"/> No _____ / _____ <input type="checkbox"/> N/A Intl Date	<input type="checkbox"/> Yes <input type="checkbox"/> No _____ / _____ <input type="checkbox"/> N/A Intl Date
Job Hazard Analysis	<input type="checkbox"/> Yes <input type="checkbox"/> No _____ / _____ <input type="checkbox"/> N/A Intl Date	<input type="checkbox"/> Yes <input type="checkbox"/> No _____ / _____ <input type="checkbox"/> N/A Intl Date
Drawings and other design documents per Appendix D of DOE G423.1-1A	<input type="checkbox"/> Yes <input type="checkbox"/> No _____ / _____ <input type="checkbox"/> N/A Intl Date	<input type="checkbox"/> Yes <input type="checkbox"/> No _____ / _____ <input type="checkbox"/> N/A Intl Date
Training Records	<input type="checkbox"/> Yes <input type="checkbox"/> No _____ / _____ <input type="checkbox"/> N/A Intl Date	<input type="checkbox"/> Yes <input type="checkbox"/> No _____ / _____ <input type="checkbox"/> N/A Intl Date

Surveillance Requirements (SR) Records	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	_____ / _____ Intl Date	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	_____ / _____ Intl Date
In Service Inspection (ISI) Records	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	_____ / _____ Intl Date	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	_____ / _____ Intl Date
Section 3 - SB Training Verification				
<p>Instructions: Review training records and interview affected project personnel to determine the level of knowledge associated with the subject SB change(s).</p> <p>Has a Job Task Analysis or similar tool been used to identify the populations of personnel directly affected by the SB change?</p> <p>Yes <input type="checkbox"/> No <input type="checkbox"/></p> <p>Have the facility's operations and support personnel been formally briefed about the SB change?</p> <p>Yes <input type="checkbox"/> No <input type="checkbox"/> Attach a copy of the training roster to the checklist (optional).</p> <p>Is the training material, including records and training conducted, current/appropriate for the SB change?</p> <p>Yes <input type="checkbox"/> No <input type="checkbox"/></p> <p>Do personnel interviewed demonstrate an understanding of the new or modified SB controls and basis for development of the control?</p> <p>Yes <input type="checkbox"/> No <input type="checkbox"/></p> <p>Note: If there are personnel requiring training to the SB change who have not received it because they were absent from the facility during the original training presentation(s), ensure that there is a plan to brief them on the SB change before re-assuming any applicable role(s) that are affected by the SB change.</p>				
Section 4 - Facility/System Modification Verification				
<p>Instructions: Examine facility systems and components affected by SB change(s) to ensure that modifications are complete and accomplished in accordance with approved design documents, and that requisite testing has been completed.</p>				
Facility/System Modification	Modification Complete and Tested?			
	Fully Implemented		Independent Reviewer	
System/Component Modified	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	_____ / _____ Intl Date	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	_____ / _____ Intl Date
System/Component Tested	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	_____ / _____ Intl Date	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	_____ / _____ Intl Date
Section 5 - Record of Review Activities				
<p>Instructions: Provide a brief listing of IVR assessment activities conducted.</p> <ul style="list-style-type: none"> ▪ Documents Reviewed ▪ Personnel Interviewed ▪ Equipment/Activities Observed 				

Section 6 - Checklist IVR Findings

Instructions: List as findings, any implementation issues identified in Sections 2, 3, or 4 of this worksheet. Provide a brief description, and narrative for each finding. Finding descriptions and narratives must be sufficient to ensure that the line management can initiate appropriate corrective actions.

Note: While common issues (such as multiple instances of training deficiencies) may be grouped as a single finding, implementation deficiencies exhibiting a unique character should be identified as independent findings.

Section 8 – Certificate of Checklist Completion

I certify completion of the Checklist IVR for the subject SB change. With the exception of findings identified in Section 7 of this Checklist, the following implementation elements were verified:

- All applicable Checklist criteria and Checklist questions have been addressed using currently available facility information and IVR assessment techniques.
- Facility personnel have been provided appropriate training to implement the SB change, and have demonstrated adequate knowledge of the SB change.
- Requirements have been implemented into appropriate facility work instructions or Safety Management Program (SMP) documentation, and in my/our judgment.
- SB change(s) are verified to be implemented within the facility.

Signature of Team Leader/Organization/Date

Signature of Independent Reviewer/Organization/Date

Section 9 – Line Management

I acknowledge and accept the results documented on this Checklist IVR.

Signature of Line Management / _____
Date

Form 4**Surveillance Requirements (SR) or In-Service Inspection (ISI) Verification Checklist**

A verification checklist can be prepared for an In-Service Inspection (ISI) or Surveillance Requirements (SRs). Such a checklist can be prepared for each new or modified hazards control requiring a surveillance/inspection in a facility safety basis document to verify that affected standards have been mapped to their respective safety basis document. Initials and date indicate that the standard and steps used are accurate for the standard identified to meet the surveillance requirements and that the steps have been verified. The checklist should include surveillances performed for passive design features subject to deterioration. See the example checklist below.

Verification of SR/ISI performance is a critical step in establishing facility readiness to operate under new or modified safety basis controls. At a minimum, the IVR should verify that baseline SR/ISI data has been recorded and acknowledged by the facility operations staff. A more desirable approach would be to observe performance of the SR/ISR. In either case, if conduct of the SR/ISI cannot be demonstrated due to impact on facility operations under an existing safety basis, the IVR should status SR/ISI performance as a finding pending completion of surveillance/inspection activities.

A similar checklist should be developed to map facility SACs, or other administrative controls that include implied surveillance or control requirements, to their implementing standards.

Surveillance Requirement (SR) or In-Service Inspection (ISI) Verification Checklist					
SR/ISI		Frequency	Standard	Standard Step	Verified by:
4.3.1.1	Test each detector to verify response to a neutron source and an alarm state for the detector is received.	Once per month	YXX-ZZ-AA	X.Y.Z [a], "Detector Test"	_____ Init/date

Form 5**SAC Implementation Review Criteria**

The following observations may be useful in supporting review of the implementation of SACs.

1. There is clear linkage from the SAC implementing procedure(s) to the TSR and its safety function.
2. The SAC has been written so that facility operators can perform the task(s) called for within the time and under the conditions assumed in the TSR/DSA. These factors need to be weighed in evaluating a SAC:
 - the adequacy of the description of the task(s) in the SAC implementing procedures;
 - the level of difficulty of the task(s);
 - operator training and capabilities;
 - the design of the equipment;
 - adequacy of feedback indicators such as indicators and alarms;
 - the time available to perform the task(s) and to recover from errors; and
 - actual facility conditions and stress levels caused by or complications created by work constraints or the work environment. These conditions among other should be considered: donning PPE, obtaining required approvals, security requirements, noise levels, heat/humidity, accessibility, and availability of communications equipment.
3. Changes to SAC requirements, documents, and instrumentation and controls and support equipment are (a) adequately designed, reviewed, approved, implemented, tested, documented, and (b) effectiveness is verified or validated by individuals or groups other than those who performed the work. Verification and validation work is completed before approval and implementation of the SAC. Only the current approved versions of SAC procedures are used.
4. Facility personnel responsible for implementing the SAC have been fully trained and qualified on SACs in general and specifically on the SAC being implemented. This requirement includes training of qualified observers who may be performing independent verifications. SAC re-qualification requirements and associated frequencies are defined, adequate, and met.
5. Facility operating processes, protocols, and procedures do not allow the facility to operate in modes or under conditions where the SAC is required but where full compliance has not been confirmed. Confirmation of SAC compliance during required modes of operation is documented.

- 6 SACs should be evaluated against the guidance in DOE-STD-1186-2004. In particular, the effectiveness of SACs should be evaluated against the measures outlined in Section 3 of that Standard. SACs that do not contain at least one or more of the recommended attributes would generally be considered inadequate.

Appendix D: Conversion of Technical Specifications and Operational Safety Requirements to Technical Safety Requirements

This appendix gives contractors guidance on converting DOE-approved technical specifications (TSs) and operational safety requirements (OSRs) into TSRs.

1 Converting TSs to TSRs

This conversion can be guided by a screening form such as that shown in Figure B.1. This form would be used for each TS. Any requirement that generated a positive response to any of the seven criteria would be included in the TSR. Specifications being added to the TSR could be categorized as SL, LCS, or LCO, according to the guidance in Section 4.2 of this Guide.

2 Converting OSRs to TSRs

For nuclear facilities with existing OSRs that have not been formatted as TSRs, the conversion can be assisted with the use of a screening form such as that in Figure B.2. This form would be used for each existing requirement. Any requirement that generated a positive response to any of the seven criteria would be included in the TSR. Requirements being transferred to the TSR could be categorized as SL, LCS, or LCO according to the guidance in Section 4.2 of this guide.

3 Additions to TSs and OSRs

After the conversion process is completed, the applicable DSA's section on TSR derivation should be used to ensure that all necessary TSRs have resulted from the conversion process.

TECHNICAL SPECIFICATION LIMITING CONDITION FOR OPERATION (LCO) SCREENING FORM

TECHNICAL SPECIFICATION NUMBER: _____

Page ____ of ____

EVALUATION

Is the technical specification applicable to—	YES	NO
A. Installed instrumentation used to detect and indicate in the control room or other control location a significant degradation of physical barriers that prevent the uncontrolled release of radioactive or other hazardous materials; or		
B. A structure, system, or component that is part of the primary success path and which functions or actuates to mitigate an accident or transient that involves the assumed failure of, or presents a challenge to, the integrity of a radioactive or other hazardous material barrier; or		
C. A process variable that is an initial condition to a design basis accident or transient that involves the assumed failure of, or presents a challenge to, the integrity of a radioactive or other hazardous material barrier; or		
D. Experiments or experimental facilities that could provide a path for the uncontrolled release of radioactive or other hazardous material or that could affect criticality; or		
E. Systems and equipment used to handle fissile material outside the reactor core; or		
F. Systems and equipment needed for Defense-in-Depth per DOE-STD-3009 to prevent a challenge to safety class systems or a significant challenge to physical barriers that protect against an uncontrolled release of radioactivity; or		
G. Systems and equipment needed for worker protection per DOE-STD-3009 to prevent serious injury or life threatening hospitalization to workers.		

If the answer to any of the above is “yes,” and the item is needed to keep off-site dose below the Evaluation Guideline of 25 rem CEDE, then the technical specification should be included in the LCOs unless justified otherwise. For items marked “yes” for Defense-in-Depth or worker safety, although most items should become LCOs in the TSR, some may be identified as only administrative controls.

Figure D.1: Example Technical Specification LCO Screening Form.

**TECHNICAL SPECIFICATION LIMITING CONDITION FOR OPERATION (LCO)
SCREENING FORM (continued)**

TECHNICAL SPECIFICATION NUMBER: _____

Page ____ of ____

DISCUSSION

<p>Explain why the specification does or does not meet the criteria and note any special considerations why a particular specification should or should not be included in the TSR (attach additional pages if necessary). This part should also include the following specific information.</p>		
<p>If the specification is found to meet criterion “B” or “C” above, provide examples of the accidents or transients for which the specification represents an initial condition or that it is assumed to mitigate.</p>		
<p>Where a component, structure, or system has more than one purpose or function that is addressed in technical specifications, reference the other specifications for the other functions.</p>		
<p>If the specification does not meet any of the criteria, a short description of the requirements should be provided.</p>		
<p>CONCLUSION: This technical specification is included in the Technical Safety Requirements.</p>	YES	NO

Figure D.1: Example Technical Specification LCO Screening Form (continued).

OPERATIONAL SAFETY REQUIREMENTS LIMITING CONDITION FOR OPERATION (LCO) SCREENING FORM

OPERATIONAL SAFETY REQUIREMENTS NUMBER: _____

Page ____ of ____

EVALUATION

Is the operational safety requirement applicable to—	YES	NO
A. Installed instrumentation that is used to detect and indicate in the control room or other control location a significant degradation of the physical barriers that prevent the uncontrolled release of radioactive or other hazardous materials; or		
B. A structure, system, or component that functions or actuates to mitigate an accident or transient that involves the assumed failure of, or presents a challenge to, the integrity of a physical barrier that prevents the uncontrolled release of radioactive or other hazardous materials; or		
C. A process variable that is an initial condition for those design basis accidents or transient analyses that involve the assumed failure of, or presents a challenge to, the integrity of a radioactive or other hazardous material barrier; or		
D. Experiments and experimental facilities that could provide a path for the uncontrolled release of radioactive or other hazardous materials or that could affect criticality; or		
E. Systems and equipment used to handle fissile materials; or		
F. Systems and equipment needed for Defense-in-Depth per DOE-STD-3009 to prevent a challenge to safety class systems or a significant challenge to physical barriers that protect against an uncontrolled release of radioactivity; or		
G. Systems and equipment needed for worker protection per DOE-STD-3009 to prevent a serious injury or life threatening hospitalization to workers.		

If the answer to any of the above is “yes,” and the item is needed to keep off-site dose below the Evaluation Guideline of 25 rem CEDE, then the operational safety requirement should be included in the LCOs unless justified otherwise. For items marked “yes” for Defense-in-Depth or worker safety, although most items should become LCOs in the TSR, some may be identified as only administrative controls.

Figure D.2: Example Operational Safety Requirements LCO Screening Form.

**OPERATIONAL SAFETY REQUIREMENTS LIMITING CONDITION FOR
OPERATION (LCO) SCREENING FORM (continued)**

OPERATIONAL SAFETY REQUIREMENTS NUMBER: _____

Page ____ of ____

DISCUSSION

<p>Explain why the requirement does or does not meet the criteria and note any special considerations why a particular requirement should or should not be included in the TSR (attach additional pages if necessary). This part should also include the following specific information.</p>		
<p>If the requirement is found to meet criterion “B” or “C” above, provide examples of the accidents or transients for which the specification represents an initial condition or that it is assumed to mitigate.</p>		
<p>Where a component, structure, or system has more than one purpose or function that is addressed in operational safety requirements, reference the other requirements for the other functions.</p>		
<p>If the requirement does not meet any of the criteria, a short description of the requirements should be provided.</p>		
<p>CONCLUSION: This operational safety requirement is included in the Technical Safety Requirements.</p>	<p align="center">YES</p>	<p align="center">NO</p>

Figure D.2: Example Operational Safety Requirements LCO Screening Form (continued)